

Article

Complementary Effect of Knowledge Management Strategy on Firm Performance: Evidence from Chinese Firms

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Received: 25 May 2019; Accepted: 25 June 2019; Published: 1 July 2019



Abstract: This study investigated the complementary effect of three orientations of knowledge management (KM) strategy on firm performance: external and internal, explicit and tacit, and exploratory and exploitive. We propose a theoretical framework for examining the synergistic effects of KM strategy on firm performance, and the moderating effect of organizational structure. The complementary effect among these orientations of KM strategy was studied. To test our framework, we conducted a survey with a sample of 345 Chinese firms that had applied a KM strategy. The empirical results show that: (1) different KM strategy orientations complement each other, and this complementarity is an essential link in the relationship between KM strategy and firm performance; (2) the direct effect of each orientation of KM strategy on firm performance is not significant; (3) a centralized organizational structure moderates the relationship between KM strategy and firm performance, thus the more centralized is the organizational structure, the stronger is the positive impact of the complementary effect of KM strategy on firm performance; and (4) the moderating effect of formalized organizational structure in the relationship between KM strategy and firm performance is not significant.

Keywords: KM strategy; complementary; firm performance; centralized organization; formalized organization

1. Introduction

The knowledge-based view sees firms as institutional arrangements that create, integrate and apply knowledge [1] (pp. 159–178). From this perspective, firms' knowledge and knowledge management (KM) are major factors in explaining differences in performance among firms [2,3], and create sustainable competitive advantages for companies [4]. Thus, an appropriate KM strategy could help firms to integrate their leadership, organizational process, organizational culture, and employees, thereby enhancing the effectiveness of knowledge creation, sharing, and utilization at the individual or work unit level [5], and improving organizational effectiveness [6].

As KM strategy has become a concern for many firms, a critical question has arisen: How does KM strategy affect organizational performance? Previous studies examined this issue in three ways. The KM literature concentrates on the synergistic effects of different orientations of KM strategy [7,8], the fit among KM strategies, or the alignment patterns of one specific strategy (e.g., ITM, HRM, and Business) with KM strategy [9–11] on performance outcomes. Some scholars identify the factors that affect KM effectiveness or organizational effectiveness through different KM strategies [5,6,12,13]. By building contingency models of KM strategy, prior research has argued that contingency factors

such as environmental contexts play a significant role in the effects of KM strategy on performance outcomes [14,15].

However, despite an abundance of research in the KM literature on the relationship between KM strategy and organizational performance, the results are inconclusive. Some scholars recommend concentrating resources on a specific KM strategy [16,17], while others argue that building a balanced and combined KM strategy is a better way to promote performance [18–21]. In this paper, we fill this theoretical gap by applying complementarity and organizational ambidexterity theories. More specifically, we build on and extend this research by focusing on the effectiveness of KM strategy and exploring the complementary effect of different KM strategies on firm performance. In doing so, we identify three key types of KM strategy orientation, and consider both the synergistic effects of those KM strategies and the moderating effects of organizational structure on the relationship between KM Strategy and firm performance.

This paper contributes to the literature by emphasizing the complementary effects of different orientations of KM strategy. We extend prior research by integrating exploitative- and exploratory-oriented KM strategies. Recent developments in organizational ambidexterity strongly suggest that balancing exploration and exploitation is a key determinant of both KM strategy and sustained performance [22,23]. Our study resolves those conflicting findings by unpacking the complex relationship between KM strategies and organizational performance, and offers a novel explanation for performance variances through the synergy of different KM strategies. In addition, this paper extends the contingency approach to KM strategy in the context of China and by examining the moderating role of organizational structure. From the perspective of organizational design, organizational structure is a determinant of exploration and exploitation [24,25], which implies that organizational structure could influence the combined effects of exploitative- and exploratory-oriented KM strategies on firm performance. However, an effective KM strategy should create a link with a firm's organizational structure [26] (pp. 117–146). However, research does not explain the role of organizational structure in the effectiveness of KM strategy. Hence, our study provides insights into how the formalization and centralization of organizational structure moderate the relationship between KM strategies and organizational performance, and sheds additional light on how organizational design can enhance the effectiveness of KM strategy.

The remainder of this paper is as follows. First, we introduce the theoretical background and present our key hypotheses. We then explain the data collection and variables. Following that, we summarize the methodology of the study and present the results of the empirical analysis. We conclude with the implications and limitations of our research.

2. Theoretical Background and Hypotheses

2.1. Definition

The terms “knowledge strategy” and “knowledge management strategy” are often used interchangeably in the literature. Zack [27] (pp. 268–276) argued that a knowledge strategy is a knowledge-based strategy that emerges when a firm develops a competitive strategy based on its capability and knowledge resources. However, once the firm realizes its knowledge resources shortage or surplus through strategic analysis, preparing to enrich its knowledge resources and improve the efficiency of knowledge resources exploitation, a knowledge management (KM) strategy must be developed as guidance for specific knowledge management activities. A knowledge strategy focuses on what knowledge is of strategic significance and why; a knowledge management strategy defines and guides the process and framework of knowledge management activities. Consequently, formulating a KM strategy is not an easy task. A company needs to consider what and how knowledge should be accessed, processed, and exploited, and the methods and tools for achieving KM-related goals [26] (pp. 117–146). A KM strategy is usually comprised of numerous dimensions, generally explicit and tacit knowledge, knowledge exploration and exploitation, organizational and technological

mechanisms [27,28]. Combining with the findings of other scholars [29], we define KM strategy as a set of decisions on basic principles and directions of knowledge management.

2.2. Frameworks of KM Strategy

Based on some case studies, two frameworks of KM strategy were constructed. One framework proposed by Hansen et al. [16] emphasized knowledge storage and ways of dissemination, including codification and interpersonal KM strategies. The other framework proposed by Bierly and Chakrabarti [29] was streamlined by Zack [21] into four dimensions: knowledge exploration and exploitation that focus on knowledge application, and internal and external knowledge, focused on knowledge sources.

Two knowledge management modes are similar to the combination of the two frameworks. The cognitive mode contains characteristics of codification and knowledge exploitation; the group mode contains interpersonal and knowledge exploration characteristics. Choi et al. [30] selected parts of dimensions from both frameworks to build a new integrated framework.

The two construct frameworks of KM strategy proposed by Hansen et al. [16] and Zack [21] are widely cited by scholars. The frameworks complement each other and focus on different aspects of KM strategy. They also fit the knowledge management system of knowledge acquisition, knowledge dissemination and knowledge application raised by early scholars [31]. Thus, we generalize the major dimensions of KM strategy from the literature into an integrated framework. Then, each orientation was put in the intergrade frameworks.

(1) Knowledge acquisition. External orientation emphasizes the acquisition of external knowledge, usually appearing in publications, on the Internet, in universities, at institutions, from consultants, and partners. Customers are also an important source of external knowledge [17]. Internal orientation emphasizes acquisition of internal knowledge, what exists in the minds of internal staff, and permeates organizational behaviors and processes. Employees, experts, and documents of a firm are internal knowledge resources [32].

(2) Knowledge storage and dissemination. Explicit orientation emphasizes knowledge coding, diverse forms of documents that store and transmit knowledge, helping employees acquire and share knowledge [33]. Tacit orientation emphasizes interpersonal communication which increases the dissemination of knowledge through social networks via social media [34]. Informal conversations of employees, experts' demonstration and guidance, "mentoring", etc. are the ways of acquiring and sharing knowledge [35].

(3) Knowledge application. Exploratory orientation emphasizes the exploration of new knowledge, encouraging innovation and investment in R&D. This orientation brings first-mover competitive advantages due to the new technology or business model, but also forces the R&D firm to accept the risk of trial and error [36]. Exploitative orientation emphasizes the consolidation, integration, and improvement of existing knowledge. This orientation is robust and can benefit from knowledge improvement without too much of an investment in R&D, but it is easily limited to the old path of knowledge, and firms will be trapped when old knowledge is eliminated [37,38].

2.3. Dimensions of KM Strategy

KM literature explores the direct impact of KM strategies on organizational performance. Those empirical results indicate some significant associations between core elements in KM strategy and performance outcomes [8,39]. For instance, different orientations of KM strategy (e.g., explicit- or tacit-oriented, external- or internal-oriented, and communities of practice- and human-oriented) and the relationships among those orientations exhibit synergistic effects of KM strategies on organizational performance [11,20,40]. The literature depends on whether they relate to our definition of KM strategy, rather than focusing on the use of the terminology of KM strategy. Organizations would present seven learning orientations and ten learning drivers as a learning system [41,42].

Each learning orientation is divided into two poles. They put these learning orientations and driven into a three-part knowledge management framework: knowledge acquisition, dissemination, and application. Knowledge acquisition contains knowledge sources (external vs. internal) and product flow concentration (product vs. procedure); knowledge dissemination contains file management mode (personal vs. public) and dissemination mode (formal vs. informal); knowledge application includes learning concentration (incremental vs. radical) and value chain concentration (emphasis on production design vs. emphasis on sales and distribution); and skills development (individual vs. of team skills) is not subordinate to any part of these alone, while it affects them simultaneously.

Subsequently, DiBella et al. [41] performed a case study on organizational learning of four large firms by using this framework, added empirical evidence to this theoretical framework. Bierly and Chakrabarti [29] conducted a seminal empirical study on the relationship between KM strategy and firm performance based on longitudinal data from U.S. pharmaceutical firms. They divided KM strategy into several dimensions: internal vs. external learning, incremental learning and radical learning, learning speed, and basic knowledge breadth.

Now, we could conclude that knowledge acquisition contains concentration (internal vs. external acquisition) and search (random vs. directional search); problem-solving includes positioning (individual vs. team), procedure (trial and error vs. inspiration), behavior (empirical vs. abstract), and range (incremental improvement vs. radical change); knowledge dissemination consists of process (formal vs. informal) and margin (narrow vs. wide); knowledge ownership comprises identity (individual vs. collective) and human resources (experts vs. generalists); and knowledge storage and memory only contains forms of knowledge presentation (explicit vs. tacit). Generally, these three types of orientations can embody most KM strategy dimensions appearing in the literature. However, explicit and tacit orientations contain the implications of personal and public knowledge, formal and informal dissemination.; exploratory and exploitative orientations contain the similar implications of progressive and radical learning, progressive improvement and radical change. Although previous literature in this field have identified the three types of KM strategy orientation under three dimensions, Choi and Lee [43] and Choi et al. [7] regarded them as different dimensions and pointed out one of three types of KM strategy orientation is firm's selection. Thus, from the perspective of indicators measurement, those different types of KM strategy orientation could be independently measured by six indicators on the same level in our empirical study.

2.4. KM Strategy and Firm Performance

The alignment among KM strategies, and the fit between patterns of one specific strategy (e.g., ITM, HRM, and Business) or KM process and KM strategy, could significantly influence performance outcomes [9,11,44]. Some scholars have different views on mechanisms how KM strategy enhance firm performance from different KM strategy orientations. Firms would perform well when emphasizing both explicit and tacit orientations [43,45]. Internal knowledge transfer intensifies the influence of external knowledge acquisition on innovation output [32]. Exploratory and exploitative knowledge sharing should balance each other to improve knowledge governance and firm's performance [36,38]. As to explicit and tacit orientations, Hansen et al. [16] argued that firms should lay particular stress on one of these two, and the resource allocation ratios of the major and secondary orientations should be 80% and 20%, respectively. If the ratios were 50% to 50%, this allocation would negatively affect firm performance. Choi and Lee [43] found that firms doing well in both explicit and tacit orientations would exceed others which emphasize only one orientation in firm performance. Zack [21] argued that different orientations are complementary to each other, and firms executed balanced orientations has the best performance [46,47], consistent with the result of empirical studies [32,35,37,38].

Obviously, there is disagreement on the relationship among KM strategy orientations [7], and complementary and non-complementary mechanisms of KM strategy orientations affecting firm performance have been concluded. Advocates of the "complementary mechanism" [21,43] proposed that complementarity among KM strategy orientations is mutually reinforcing. All orientations are

mutually coordinated, integrated, systematically affecting firm performance, the complementarity helps to balance development and achieve a competitive advantage. Conversely, believers in the “non-complementary mechanism” [16] see no complementary relationship among KM strategy orientations and firm performance. The non-complementarity helps to achieve a competitive advantage with limited resources, could depend on identifying the orientation for firm performance, pooling resources and doing the best on the orientation. Thus, “whether there exists complementarity among KM strategy orientations” should be further tested.

2.5. Complementarity Effects of KM Strategy

In the literature of organizational economics, the complementary effect is defined as follows: if there are several activities, with the increase of one activity, the marginal profitability of the rest rises, correspondingly [48]. There have been empirical studies on the complementarity of different operative activities within firms [49–51]. The complementary effect is seen when the marginal profitability of several KM strategy orientations increases mutually. There are two elements of the complementary effect.

The first is that many resource inputs are versatile in various KM strategy orientations, which decrease the cost of KM strategy. Orientations would benefit from the investment in information technology, firm culture, or human resources. In other words, an established computer network not only supports the external orientation such as collecting information from the Internet and contacting customers through emails, but also supports the internal orientation such as internal forum, internal email system, thus fostering a firm’s culture of learning promotes both knowledge exploration and exploitation, as well as the dissemination and sharing of explicit and tacit knowledge, which, by introducing and training high-quality human resources, can strengthen KM strategy orientations.

The second is that effects of various orientations are synergistic, which means added value beyond the individual effect of a single orientation [7]. For example, the knowledge of market and customer obtained through external orientation complements the ideas of new product designs obtained through exploratory orientation thereby increasing the success of the new product development. The tacit orientation encourages employees to disseminate and share their knowledge. However, internal orientation emphasizes refinement and recognizes the value of the knowledge contributed by employees. Employees are encouraged to share tacit knowledge, so the combined orientations create a virtuous cycle.

Then, the emergence of cost saving and added value jointly contributes to the complementarity among KM strategy orientations. Thus, the following hypotheses are proposed:

Hypothesis 1a. *KM strategy orientations are complementary, synergistically affecting firm performance.*

Although our theoretical analysis supports the view of “complementarity”, we still need to examine the competitive hypothesis opposite H1a:

Hypothesis 1b. *KM strategy orientations affect firm performance with a substitution effect.*

2.6. Contingency Factors: The Moderate Effects of Organizational Structure

Another stream of research suggests that KM strategies are context-specific and can have a deep impact on the effectiveness or performance of both KM and the organization. Those contingency models demonstrate that cultural environment [44,52], different phases in the industry life cycle [53], intensity of environmental knowledge [15], and intra-unit task environment [5] play important roles in the relationship between KM strategy and performance or effectiveness outcomes. Thus, KM strategy should continually co-align its knowledge-based resources with those contingency factors, especially the environmental contexts, which facilitate coordination of a company’s major goals and learning in time [14]. Some scholars concentrate on which factors affect KM effectiveness through different KM

strategies [6,12]. Their findings reveal that codification [54], relational learning [55], and organizational structure [5,13] are significant in balancing KM strategy against KM effectiveness. Recent research on organization design and organizational ambidexterity suggests that organizational structure helps to balance exploration and exploitation [24,25]. Therefore, the organizational structure should align with an exploitative- or exploratory-oriented KM strategy, which would promote the effectiveness of KM strategy in facilitating knowledge searching, recombination and sharing in an organization [26] (pp. 117–146).

We explored the moderating effect of organizational structure in the relationship between KM strategy and firm performance by considering the centralization and formalization of organizational structure. Centralization reflects the locus of authority and decision making. If decision making is concentrated at the top of an organization, centralization is high. Formalization is the degree to which firms regularize their employees' behaviors through rules and procedures [56]. The more comprehensive and standard rules and procedures are, the greater the formalization. Although most scholars believe that organizational structure is an important moderator in KM strategy [21,57,58], few have provided empirical evidence.

Centralization concentrates and isolates knowledge at the senior level, which is not conducive to knowledge exploration and exploitation [57] (pp. 277–295). Decentralization, however, disperses knowledge at lower levels, thereby interfering with knowledge application [59].

Some scholars believed the relationship between formalization and KM strategy is not conducive to new knowledge acquisition and application, due to the rigidity of the formalized organizational structure [60]. However, knowledge transfer mechanisms arise as a result of both formal and informal structure. Formalization prompts knowledge collection and effective experience on the organizational operation, which improves the efficiency of KM strategy [61].

We believe there is complementarity among KM strategy orientations, thus it is reasonable to highlight the moderating effect of organizational structure. Tracing back to cost saving and added value, centralization is conducive for senior level to systematically allocate resource on orientations, better utilization of resources versatility, and more added cost saving. Additionally, because different departments usually stress different KM strategy orientations (for instance, the marketing department on external orientation, the IT department on explicit orientation, and the R&D department on exploratory orientation), centralization makes it possible for the senior level to coordinate different departments' KM strategies. Thus, we put forward this hypothesis:

Hypothesis 2. *The relationship between KM strategy and firm performance is moderated by centralized organizational structure; the higher centralization is, the stronger positive effect of the complementary effect of KM strategy orientations on firm performance is.*

Similarly, we argue that formalization is conducive not only to the standardization of knowledge management, but also to versatility, which results in cost savings. In addition, formalization modularizes functional departments and regularizes business processes, both of which improve interdepartmental convergence and promote coordination among KM strategy orientations. This leads to the following hypothesis:

Hypothesis 3. *The relationship between KM strategy and firm performance is moderated by the formalization of organizational structure, and the higher formalization is, the stronger positive effect of the complementary effect of KM strategy orientations on firm performance is.*

Based on the theoretical deduction, the proposed hypotheses are summarized into a conceptual model in Figure 1.

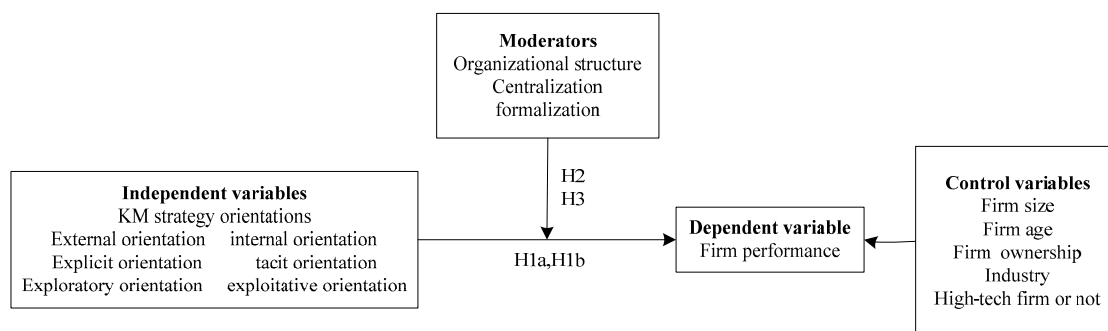


Figure 1. Conceptual framework.

3. Data and Methodology

3.1. Sample and Data Collection

The survey was examined and revised by managers from several industries. Two hundred questionnaires were sent out, and 113 valid ones returned. Then, we simplified the scales of firm performance and organizational structure. The KM strategy scale consists of 24 items. The firm performance scale has four, while the scales of centralization and formalization each contain three (please see Supplementary Materials for more details of the survey questionnaire).

This study adopted two sampling methods. One was to survey the firms' managers from Shanghai, Anhui, and Chongqing (representing eastern, central and western China). The second method was to survey the research team's cooperating firms in Beijing, Jiangsu, Zhejiang, Fujian, and Guangdong, by posting or via email. Eight hundred questionnaires were issued, and 436 were returned, for a response rate of 55%. We excluded the invalid questionnaires following the rules: (1) missing answers; (2) the responses showed regularity; (3) questionnaires were completed by respondents from non-competitive industries, such as water supply, power supply, gas supply, postal service, tobacco, and salt industry; and (4) questionnaires came from nonprofit units such as schools and hospitals, not competitive industries. Finally, we received 345 valid questionnaires. The samples came from a range of industries, which we divided into two categories according to "Stipulation for Three Industry Divisions" published by National Bureau of Statistics (NBS) in 2003.

3.2. Measurement

The items were derived from literature, which were selected from the existing scales and theoretical literature [62,63]. KM strategy orientations were measured by 24 items. Firm performance was measured by the scale used by Wang et al. [64] that is applicable in the Chinese context and correlates significantly to firm performance. Centralization and formalization were separately measured with items of organizational structure designed by Ferrell and Skinner [65] and Caruana et al. [66]. All variables were measured by a five-point Likert scale. The performance scale ranged from 1 (very low) to 5 (very) high, which was complemented by respondents, in comparison with major competitors; the rest scales ranged from 1 (strongly disagree) to 5 (strongly agree). Firm size (staff population), firm age, firm ownership, industry (manufacture, service, and others) and dummy variable of the high-tech firm were introduced as control variables. These measurement items were reviewed repeatedly by two management professors and three management PhDs. Next, we examined the reliability and validity of the scales. Then, a structural equation model was used to test H1a and H1b, and a regression analysis of moderators was conducted to test H2 and H3. SPSS11.5 and LISREL 8.7 were adopted as analysis software.

4. Analysis and Results

4.1. Descriptive Statistics

Samples of the second industry comprise manufacturing and a few construction and extractive industries; samples of the third industry comprise real estate development, transportation, financial services, telecommunication services, commerce, consulting, intermediation, computer software and networking business, commercial services, resident services, and other services. Table 1 shows descriptive statistics for the samples.

Table 1. Descriptive statistics of samples.

Firm Ownership			Firm Location		
Type	Sample size	Proportion (%)	Province	Sample size	Proportion (%)
State-owned	174	50.4	Shanghai	50	14.5
Private	88	25.5	Other eastern provinces	51	14.8
Foreign-invested	69	20.0	Anhui	113	32.8
Other	14	4.1	Chongqing	131	37.9
Firm Size (Staff Population)			Respondent Position in the Firm		
Population	Sample size	Proportion (%)	Position rank	Sample size	Proportion (%)
≤100	73	21.2	senior manager	53	15.4
101–500	95	27.5	Middle manager	131	38.0
501–1000	50	14.5	Low-level manager	98	28.4
1001–5000	64	18.6	General staff	63	18.3
≥5000	63	18.3	Company Tenure		
Firm Age			Year	Sample size	Proportion (%)
Year	Sample size	Proportion (%)	Under 2 years	32	9.3
Under 2 years	3	0.9	2–5 years	143	41.4
2–5 years	47	13.6	6–10 years	111	32.2
6–10 years	80	23.2	More than 10 years	59	17.1
11–15 years	61	17.7	Department of Respondents		
More than 15 years	154	44.6	Department	Sample size	Proportion (%)
Industry			Strategic planning	21	6.1
Industry category	Sample size	Proportion (%)	administration/personnel	47	13.6
The second industry	141	40.9	Finance	38	11.0
The third industry	204	59.1	Product/service operation	80	23.2
Whether It Is a High-Tech Firm			Marketing	67	19.4
Type	Sample size	Proportion (%)	R&D	22	6.4
Positive	118	34.2	Other	45	13.0
Negative	227	65.8	Optionality	25	7.2

4.2. Reliability and Validity

KM Strategy Scale

The reliability of the KM strategy scale was tested by the Cronbach's α coefficient 0.90; the scale manifested preferred reliability. The content validity of the scale was guaranteed due to the consulted views of literature, academic experts and business circles. Thus, the construct validity including convergent validity and discriminant validity was examined, according to the confirmatory factor analysis (CFA) results ($\chi^2(237) = 538.61$, RMSEA = 0.061, GFI = 0.88, CFI = 0.97, NNFI = 0.96, IFI = 0.97, PNFI = 0.81). Goodness-of-fit indices for the model are preferred. All T values of indicators are highly significant ($p < 0.01$), indicating preferable convergent validity. We fixed the correlation coefficient at 1 successively, between every two factors, and the fitting results in which $\Delta\chi^2$ is highly significant ($p < 0.01$), showing a preferable discriminant validity.

4.3. Firm Performance Scale

The analysis of reliability and CFA of scale showed that the Cronbach's α coefficient is 0.78, which indicates preferable reliability. According to the CFA results ($\chi^2(2) = 2.08$, RMSEA = 0.011, GFI = 0.88, CFI = 1.00, NNFI = 1.00, IFI = 1.00, PNFI = 0.33), the model's goodness-of-fit is good. The range of the factor loadings of indicators is from 0.5 to 0.95, and T value for all indicators is highly significant ($p < 0.01$), which indicates a preferable convergent validity.

4.4. Organizational Structure Scale

The analysis of reliability and CFA of scale showed that the Cronbach's α for centralization and formalization are 0.97 and 0.87, indicating excellent reliability. According to the CFA results ($\chi^2(8) = 18.71$, RMSEA = 0.062, GFI = 0.98, CFI = 0.99, NNFI = 0.98, IFI = 0.99, PNFI = 0.52), the model's goodness-of-fit is good, because the factor loadings range from 0.5 to 0.95 and t value for all indicators is highly significant ($p < 0.01$), showing a preferable convergent discriminant validity. We fixed the correlation between two factors at 1, and values of $\Delta\chi^2$ are highly significant ($p < 0.01$), showing a preferable discriminant validity.

4.5. Common Method Variance Test

Based on a common method variance test, we compared the current model (nine factors: firm performance, three types of KM strategy orientations and two organizational structure dimensions) with Harman (one factor model with 34 items specified to load on one factor). The fitting results of current model are $\chi^2(491) = 1059.61$, RMSEA = 0.058, GFI = 0.85, CFI = 0.96, NNFI = 0.95, IFI = 0.96, PNFI = 0.81, while that of Harman is $\chi^2(527) = 2998.77$, RMSEA = 0.117, GFI = 0.66, CFI = 0.85, NNFI = 0.84, IFI = 0.85, PNFI = 0.77. These results show the significant difference between the two models, and the impossibility of all factors being explained by a single latent variable. Thus, common method variance bias is not serious.

4.6. Regression Analysis of Complementarity

Along with the method adopted by [50,51], this study adopted structural equation models to test *H1a* and *H1b*. Figure 2 models complementarity as a second-order construct. The first-order factors separately capture the three types of KM strategy orientation, while the second-order factor captures the complementarity of the six first-order factors. Those KM strategy orientations jointly affect firm performance via the second-order factor on behalf of complementarity. Figure 3 models the direct effect of the three types of KM strategy orientation separately on firm performance, which allows the pair-wise correlations of the three types of KM strategy orientation. There are two control variables, "firm size (staff population)" and "business year", in both models.

Based on the statistical results of complementarity model (as Figure 2), the fitting results show that the second-order factor loadings of three types of KM strategy orientation are highly significant ($p < 0.01$), and the path coefficients of complementarity and firm performance are positive and highly significant ($\beta = 0.61$, $p < 0.01$). Thus, *H1a* is supported. In fitting results of direct effect model (as Figure 3), 15 pair-wise correlations are significant, demonstrating that the three types of KM strategy orientation are tightly related, but the path coefficients of their direct effects on firm performance are not significant ($p > 0.1$). Thus, these findings reinforce *H1a*, and do not support *H1b*.

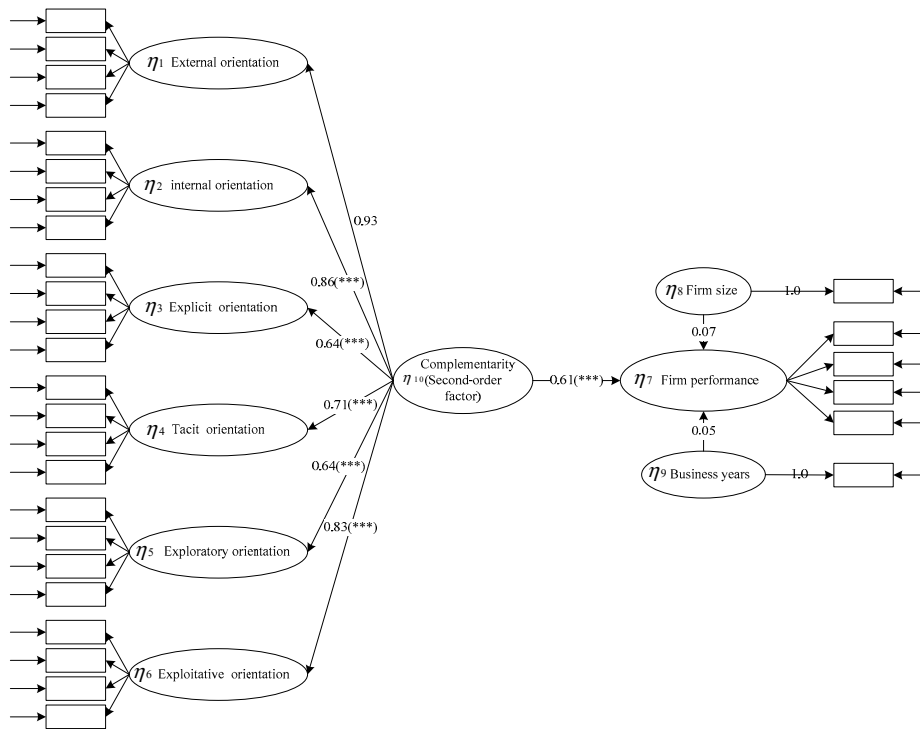


Figure 2. Performance Effects of Orientations: Complementarity (note: χ^2 (398) = 1043.16, RMSEA = 0.069, GFI = 0.83, CFI = 0.95, NNFI = 0.94, IFI = 0.95, PNFI = 0.84; *** $p < 0.01$).

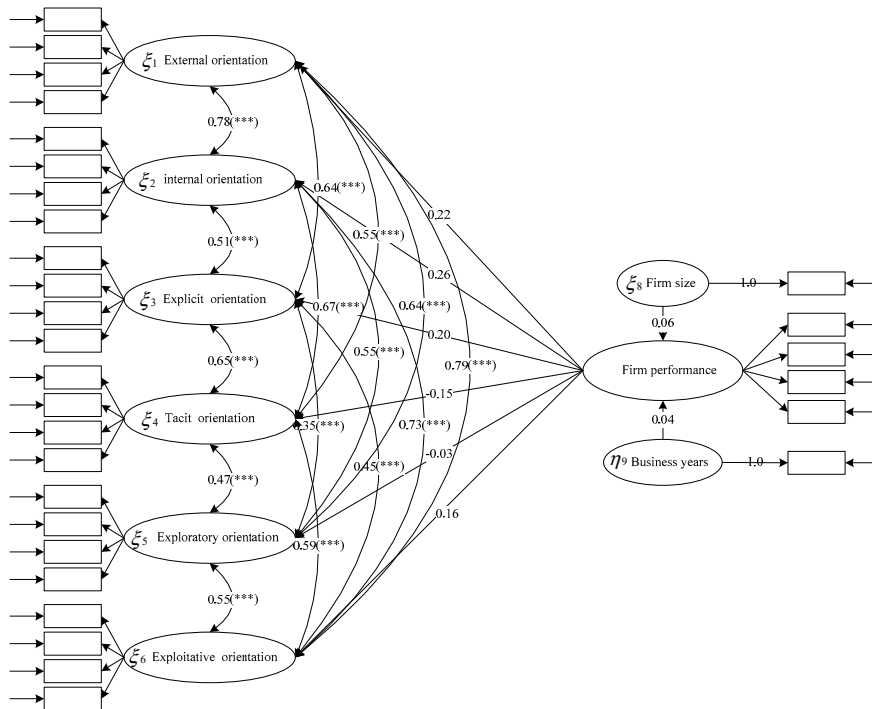


Figure 3. Performance Effects of Orientations: Direct Effects of Individual Dimensions (note: χ^2 (384) = 997.51, RMSEA = 0.068, GFI = 0.84, CFI = 0.95, NNFI = 0.95, IFI = 0.95, PNFI = 0.81; *** $p < 0.01$).

4.7. Moderate Effects

According to common practice [67], the mean of four indicators for each KM strategy orientation represents the orientation score, and that of all orientation scores represents the score of the second-order

factor: complementary effect. Scores of centralization, formalization and firm performance are represented by the corresponding means. Meanwhile, we controlled for the variables: firm ownership (1 state-owned, 0 non-state-owned), industry (1 secondary industry, 0 third industry) and whether it is a high-tech firm (1 positive, 0 negative).

We used stepwise regression analysis to test the moderating effects of organizational structure, and results are shown in Table 2. The R^2 of Model 2 increases significantly compared to that of Model 1, and the regression coefficient of complementarity is positive and significant ($\beta = 0.49$, $p < 0.01$), which indicates that complementarity has a significant positive effect on firm performance with multiple control variables, which fits the results of structural equation model testing *H1a*.

Table 2. Regression analysis of moderate effect.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Firm size	0.14 ** (2.26)	0.09 (1.56)	0.08 (1.36)	0.06 (0.98)	0.08 (1.48)	0.06 (1.08)
Firm age	0.07 (1.16)	0.08 (1.47)	0.08 (1.39)	0.09 * (1.67)	0.07 (1.31)	0.09 (1.59)
Firm ownership	-0.16 *** (-2.63)	-0.11 ** (-2.13)	-0.12 ** (-2.32)	-0.11 ** (-2.02)	-0.12 ** (-2.21)	-0.11 ** (-1.98)
Industry	-0.06 (-1.01)	-0.01 (-0.18)	-0.01 (-0.26)	-0.01 (-0.17)	-0.01 (-0.23)	-0.01 (-0.15)
High-tech firm or not	0.12 ** (2.17)	0.02 (0.41)	0.02 (0.47)	0.02 (0.31)	0.02 (0.44)	0.02 (0.31)
Complementarity		0.49 *** (10.18)	0.44 *** (8.04)	0.43 *** (7.78)	0.44 *** (8.04)	0.43 *** (7.79)
Centralization			-0.02 (-0.39)	-0.02 (-0.47)	-0.01 (-0.17)	-0.02 (-0.32)
Formalization			0.09 (1.61)	0.07 (1.25)	0.07 (1.16)	0.06 (0.99)
Centralization \times complementarity				0.12 ** (2.47)		0.11 ** (2.20)
Formalization \times complementarity					-0.07 (-1.41)	-0.04 (-0.86)
R^2	0.053	0.275	0.281	0.294	0.285	0.295
F	3.766 ***	21.349 ***	16.387 ***	15.464 ***	14.831 ***	13.982 ***
ΔR^2		0.222	0.006	0.013	0.004	0.014
ΔF		103.571 ***	1.362	6.096 **	1.995	3.419 **
Maximum VIF	1.436	1.444	1.488	1.524	1.500	1.549

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, the values of ΔR^2 of Models 4–6 are based on the Model 3.

We centralize the variable scores (minus the mean of variables) before calculating the interaction term to reduce the multicollinearity. The values of all variables' VIF are much smaller than 10, which indicate that there the results are reliable without serious multi-collinearity among variables.

In Model 3, the regression coefficients of centralization and formalization are not significant, indicating no significant direct effects on firm performance. A comparison of Models 4–6 with Model 3 found that the R^2 of Model 4 increases significantly, for the introduction of interaction term of centralization and complementarity. The regression coefficient of the interaction term is positive and significant ($\beta = 0.12$, $p < 0.05$), meaning centralization positively moderate complementarity. Therefore, *H2* is supported. With the introduction of interaction term of formalization and complementarity, the R^2 of Model 5 does not increase significantly, and the regression coefficient of the interaction term is not significant, meaning formalization does not significantly moderate complementarity. Therefore, *H3* is rejected. Model 6 demonstrates that, when two moderators are tested simultaneously, the above conclusions remain acceptable.

5. Conclusion and Discussion

This study identified three types of KM strategy orientation: external and internal, explicit and tacit, and exploratory and exploitative. The complementarity among these orientations was deduced, and the possible effects of organizational structure analyzed. Based on a survey of 345 Chinese firms, we tested the reliability and validity of the KM strategy scale, and then the relationship between KM strategy and firm performance and the moderating effect of organizational structure in this relationship. The study showed complementarity among three types of KM strategy orientations, which integrate tightly, and have a significant positive effect on firm performance. None of the KM strategy orientations has a significant effect on firm performance. Centralized organizational structure moderates the relationship between KM strategy and firm performance, and the strength of complementarity becomes stronger, as the centralization level increases. A formalized organizational structure has no significant moderating effect on the relationship between KM strategy and firm performance.

We now explain the separate effects of three types of KM strategy orientation on firm performance. Although the direct impact of each type of KM strategy orientation on firm performance is non-significant, the complementary effect among them has a great influence on firm performance. The complementarity among three types of KM strategy orientation appears to work systematically and synthetically in knowledge management, integrating knowledge acquisition, knowledge dissemination, and knowledge application as a system. This finding is enlightening as it suggests that, for a knowledge management firm, the role of any single KM strategy orientation is not sufficient to enhance the performance as the environment of the firm is complex enough.

The two kinds of organizational structures moderated the relationship between KM strategy and firm performance in different ways. The influence of formalized organizational structure on the relationship between KM strategy and firm performance is not significant. Due to the path dependence from rigidity and inelasticity in a formalized organization, changing KM strategy orientation may increase the cost. Formalized organizations may have to pay more to change KM strategy. In contrast, a centralized organizational structure is more closely related to complementarity and firm performance, and it moderates them positively. Centralized organizational structure would be beneficial at a time of strategy change; it helps to integrate different KM strategy orientations, unlike centralized organization, which blocks the exchange of information and knowledge between departments and employees.

6. Contributions

This research makes two major contributions. The study provides empirical evidence for the complementarity among KM strategy orientations. Our empirical results are consistent with the finding by Choi et al. (2008), which implies synergistic effects of KM strategies on performance. Furthermore, our work extends current research by revealing the role of another key type of KM strategy orientation (exploratory and exploitive) in such complementary effect of KM strategy. Combining the exploratory- and exploitive-oriented KM strategies with other KM strategies is important since it would not only help us understand how firms use those two KM strategy orientations to achieve different knowledge acquisition strategies (internal and external), and enhance knowledge sharing through different types of knowledge (explicit and tacit). Hence, our study indicates that the complementary is an essential intermediate link of KM strategy affecting firm performance.

This study also illustrates that a centralized organizational structure positively moderates the relationship between KM strategy and firm performance. Although some authors have confirmed the significant impact of centralization and formalization on knowledge performance [56,58,59], the effect of centralization and formalization on the relationship between KM strategy and firm performance is unclear. To the best of our knowledge, this is the first work that shows how centralization and formalization moderate such relationship. As a result, the study offers an alternative explanation for why centralization is not a necessary determinant of firm performance. It does, however, improve firm performance indirectly by contributing to the complementarity effect of KM strategy.

7. Implications for Practice

Our study makes several contributions to managerial practices. Our suggestion of a complementary effect of KM strategy on firm performance gives a strategic contribution to managers who want to promote the effectiveness of knowledge management through integrating different strategic orientations and changing the existing organizational structure. By uncovering the fact that multiple orientations bring better firm performance, this study provides evidence in support of systematic planning and special attention to the coordination of diverse orientations, departments, and resources of KM strategy, which is in line with the “bucket theory.” Simply to improve a certain aspect of activities will not achieve remarkable results. Only with coordinating various aspects of KM strategy and making use of complementarity, remarkable firm performance can be achieved. For example, when a firm executes one of three types of KM strategy orientation, the manager should carefully consider how the KM strategic orientation affect firm performance, and how to integrate several different KM strategy orientations with the existing KM strategy to develop. Because the manager has to consider the efficiency or performance for the executed KM strategy, when changing KM strategy and integrating more KM strategy dimensions, the manager should be mindful not only of how KM strategy is related but also the fit with the internal and external environments.

In addition, we aid a firm wanting to choose which organizational structure is most proper for executing KM strategy. The adopted and centralized organizational structures in state-owned firms are not necessarily barriers to KM strategy. The superiorities of centralized organizational structure in resource allocation, standardization, and cross-department coordination reinforce the application effect of KM strategy. Despite the superiorities of decentralized organizational structure in promoting organizational learning and creativity of organizational members, the fit between organizational structure and KM strategy is complex [44], and we cannot simply infer which kinds of organizational structure best manage their KM strategy.

8. Limitations and Future Plan

Beyond the consequences of our study, we see several possibilities of methodological and theoretical developments. In terms of methodology, we used a cross-sectional research design. In reality, it takes time for the effects of a KM strategy to manifest. However, a longitudinal design is more conducive to in-depth analysis of the mechanism that KM strategy acts on firm performance. Our research would conduct a time series survey for a panel data analysis. In terms of theory, we extend the KM strategy literature from a strategic perspective by identifying three types of KM strategic orientation. Further study on this topic should examine both other types of KM strategic orientation and antecedents of firm performance in various ways, according to a variety of purposes and motivations. Moreover, we need to explore the role of other mediator and moderator variables in the relationship between KM strategy and firm performance. For instance, we could consider the moderating effect of the culture of firms, or institutional environment, to gain insights into the practice of KM strategy.

Supplementary Materials: The following are available online at <http://www.mdpi.com/2071-1050/11/13/3616/s1>.

Author Contributions: Conceptualization, Y.L.; Data curation, Y.L. and L.Z.; Methodology, B.S. and Y.L.; Project administration, B.S.; Supervision, L.Z.; Writing—original draft, Y.L. and B.S.; Writing—review & editing, B.S. and L.Z.

Funding: This work was supported by National Key R&D Program of the Ministry of Science and Technology of China (Grant No. 2017YFB1401400), National Natural Science Foundation of China (Grant No.71302021), Humanities and Social Sciences projects of the Ministry of Education of China (Grant No. 17YJA630086), the program of China Scholarships Council (Grant No. 201508515045), and Management Science and Engineering Construction Funds of Southwest Minzu University (Grant No. 2019—XWD—S1201).

Conflicts of Interest: No potential conflicts of interest were reported by the authors.

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