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RESEARCH ARTICLE

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Organizational Ambidexterity and Innovation Performance: The Moderating Effect of Entrepreneurial Orientation

Abstract The influence of organizational ambidexterity on innovation and the growth of enterprises has gradually become an important research topic in the field of strategic management and organization theory. This paper builds up a theoretical framework of the relationship between organizational ambidexterity and innovation performance with regards to corporate entrepreneurship orientation. We select 175 companies from high and new technology industries in China's three large cities, Beijing, Tianjin and Dalian, as samples to carry out an empirical test. We find that the balance and complement of organizational ambidexterity are positively correlated with the innovation performance of enterprises; a corporate entrepreneurial orientation has a significantly moderating effect on the relationship between the balance dimension of organizational ambidexterity and innovation performance, yet it has no significant positive moderating effect on the relationship between the combined dimension of organizational ambidexterity and innovation performance.

Keywords organizational ambidexterity, entrepreneurial orientation, innovation performance, moderating effect

1 Introduction

Against the background of the Internet, the environment confronting high-tech industries is increasingly showing the characteristics of rapid technological renewal, changeable customer demand and fierce market competition (Carrillo,

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2005). In order to adapt to this rapidly changing environment, the importance of enterprise innovation, especially technological innovation, has attracted growing attention from academia. Some scholars even believe that the development of new technology-based products is one of the most influential explanatory variables contributing to organizational performance in our era (Osamu, 2015). Thus, the importance of innovation performance has become increasingly prominent. Innovation performance reflecting the results produced by the innovative behavior of firms is vital to firms' survival and development. A great deal of research regarding influencing factors has been carried out in domestic theory circles in recent years (Huang and Chen, 2010). These influencing factors can be divided into four factors: environmental factors, structural factors, organizational factors and individual factors. Organizational ambidexterity is one of the organizational factors influencing innovation performance. The conception of "organizational ambidexterity" is introduced into the management field by Duncan (1976), and is employed to describe a firm's capacity. Such capacity contributes to firms' daily operations and their taking advantage of resources already accumulated. Further, it enables firms to adapt to an increasingly dynamic and complex external environment and improve competitive advantage. While Duncan pays attention to integral organizational ambidexterity, March (1991) focuses on the learning capacity of organizations expressed by explorative capacity and exploitative capacity. Exploration refers to searching for and accessing entirely new knowledge, technologies and programs through more experiments and changes so as to bring out novel products. Exploitation refers to the refinement and elongation of existing knowledge and competencies, and the improvement of existing technologies and processes (Benner and Tushman, 2002).

However, whether or not organizational ambidexterity is bound to facilitate innovation and growth of firms, obviously discrepancies exist. Some scholars hold that a balance dimension of organizational ambidexterity (BD) can avoid the negative effects stemming from overemphasizing one capacity so as to enhance innovation performance. In addition, the two capacities are capable of mutual reinforcement so as to enhance innovation performance (He and Wong, 2004). Some scholars also believe that explorative capacity and exploitative capacity can lead to two distinctive behaviors, which are difficult to coordinate as they compete for limited internal resources in organizations (March, 1991).

Meanwhile, huge costs must be paid for realizing the two capacities concurrently (Menguc and Auh, 2008). Some scholars even argue that organizational ambidexterity could reduce organizational innovation (Liu et al., 2013), and is negatively related to performance (Atuahene and Murray, 2007).

The divergent results of the same research issue may result from differences in dimension constituents, measurement methods, the relationship mechanism of variables, investigation situations etc. However, the existing literature fails to investigate the role of strategic orientation behind resource allocation patterns (Wei, Yi, and Guo, 2014). Strategic orientation refers to organizational business philosophies and value systems (Ocasio, 1997). It guides a firm to balance scarce resource allocation and determines whether exploitation and exploration share or compete for scarce resources (Atuahene and Ko, 2001; Ocasio, 1997). When there is a different strategic orientation (e.g., entrepreneurial orientation), the effects of organizational ambidexterity on innovation performance will be varied. Corporate entrepreneurial orientation refers to enterprises' demands on employees to be more innovative, adventurous and proactive etc. (Lumpkin and Dess, 1996), which are used to reflect enterprises' strategic orientation or the intensity or willingness to be engaged in entrepreneurial activities. (Covin and Slevin, 1989). A corporate entrepreneurial orientation contributes to the acquisition of resources and customer knowledge for firms (Cai, Zhu, and Liu, 2011), while organizational ambidexterity is highly reliant on the knowledge, skills, and abilities of people (human capital) as well as the willingness and motivation to pursue these usages (Na, Ma, Janine, and Patrick, 2016).

As a consequence, this paper, from the perspective of contingency theory, argues that corporate entrepreneurial orientation is a situational variable. Following He and Wong's (2004) and Jiao's (2011) methods of dimensions division and the measurement of organizational ambidexterity, this paper tries to explore the moderating effect exerted by entrepreneurial orientation on the relationship between organizational ambidexterity and innovation performance.

Contingency theory is also called strain theory and contingency management theory. ''Contingency'' means to change with specific situations or to make decisions according to the specific circumstances. That is, management practice varies according to the changeable organizational environment and internal conditions.

Finally, we notice that both the balance dimension of organizational ambidexterity (BD) and the combined dimension of organizational ambidexterity

(CD) are significantly and positively related to the innovation performance of firms, and the relationship between BD and innovation performance is significantly moderated by corporate entrepreneurial orientation, while there is no significantly moderating effect of corporate entrepreneurial orientation on the relationship between CD and the innovation performance of firms. This study extends our understanding of the relationship between the two dimensions of organizational ambidexterity and innovation performance, and further enriches the research on contextual ambidexterity by identifying entrepreneurial orientation as an important context factor. Meanwhile, we also provide experience and guidance for managers in practice.

2 Theoretical Review and Research Hypothesis

2.1 Organizational Ambidexterity and Innovation Performance

Duncan (1976) proposes using "organizational ambidexterity" to denote the characteristics of conducting progressive and abrupt changes in firms simultaneously. Rothaermel and Alexandre (2009) define organizational ambidexterity as two kinds of capacities that firms possess concurrently and that could produce conflicting behaviors. Further, Zhang and Li (2009) conceptualize explorative capacity as a capacity owned by firms such as variability, testing, flexibility, adventure and innovation activities, while viewing exploitative capacity as one that includes efficiency-improving, replication, selection and implementation activities. They also make comparisons of differences between the two in aspects such as objectives, outcomes, knowledge base, performance etc., as shown in Table 1. Organizational ambidexterity employed in this paper follows Zhang and Li.

Table 1 Comparison of Differences between Explorative Capacity and Exploitative Capacity

	Explorative Capacity	Exploitative Capacity
Target	To satisfy the needs of new customers or markets	To satisfy the needs of existing customers or markets
Result	The appearance of new craft, processes and technology	The improvement of existing craft, processes and technology
Knowledge base	Using new knowledge	Developing existing knowledge
Performance	Long-term performance	Short-term performance

Source: Zhang and Li (2009).

There are two perspectives regarding studies of organizational ambidexterity and innovation performance in the existing literature. One studies the relationship between explorative (exploitative) capacity and innovation performance from several angles. The first examines the relationship between organizational ambidexterity and innovation performance directly. For example, Mladenka, Matej, and Ines (2015) find that exploration and exploitation are both positively related to innovation performance. Katila and Ahuja (2002), by employing patent data from the global robotics industry, find that exploring new technological knowledge and exploiting existing technological knowledge simultaneously will contribute to knowledge integration and thus positively affect the development of new products. The second studies the relationship between organizational ambidexterity and different innovative performance. For example, Sun, Dang, and Song (2015) point out that there is an inverted U-shaped relationship between exploration capacity and cooperative innovation performance, while exploitation capacity is able to improve cooperative innovation performance. Li and Wu (2015) find that explorative learning capacity is more likely to be subject to radical innovation performance, while exploitative learning capacity is linked to incremental innovation performance. The third studies the relationship between organizational ambidexterity and innovation performance under different circumstances. For example, Yalcinkaya, Calantone, and Griffith (2007), by studying 111 U.S. importers, find that exploitative capacity is negatively related to the level of product innovation, while exploitative capacity has a positive impact on the level of product innovation. Li and Wu's (2015) findings indicate that no matter what methods the alliance chooses (characterizing explorative learning and exploitative learning as independent activities or treating the two as integrated) to conduct explorative learning and exploitative learning, both benefit from the acquisition of knowledge from partners, whereas knowledge acquisition enables firms to enhance innovation performance. The research in this respect has been relatively well covered; thus, we will carry out our study from another perspective.

Another perspective considers organizational ambidexterity as an integral variable and unpacks this construct into different dimensions to study the relationship between them and innovation performance. In the existing literature, there is a division between researchers who consider organizational ambidexterity to have one-dimension, two-dimensions or three-dimensions

(Zhang, Liu, and Lin, 2015). Recently, Cao, Gedajlovic, and Zhang (2009) unpacked organizational ambidexterity into the two dimensions we term the balance dimension of ambidexterity (BD) and the combined dimension of ambidexterity (CD). BD corresponds to a firm's orientation to maintain a close relative balance between explorative capacity and exploitative capacity, and not over-engaging in either of them to avoid a big gap between the two. When a firm's magnitude of exploitation capacity well exceeds that of its explorative capacity, the firm is more likely to be susceptible to the success trap. Conversely, when a firm overemphasizes explorative capacity to the exclusion of exploitative capacity, the firm is more likely to be subject to the failure trap. CD indicates that explorative capacity and exploitative capacity complement and facilitate each other. Even though they bring greater conceptual clarity to the treatment of ambidexterity, there is a lack of research regarding the influence of strategic orientation (e.g., entrepreneurial orientation) on the relationship between organizational ambidexterity and innovation performance, while entrepreneurial orientation is a significant situational variable. Therefore, this paper, based on the two-dimension division of Cao et al. (2009), seeks to explore the relationship between organizational ambidexterity and innovation performance by introducing entrepreneurial orientation as a situational factor.

The existing literature has begun to explore the relationship between the balance of ambidexterity and innovation performance. Some scholars maintain that the imbalance of organizational ambidexterity is negatively related to performance, while the balance is positively related to performance (He and Wong, 2004; Wang, Chang, and Hughes, 2012). For instance, Sun, Dang, and Song (2014) point out that allocating resources reasonably and keeping balance between the two could avoid the defects caused by excessively depending on a single capacity, and could contribute to nurturing new competitive advantages, enhancing innovation capabilities and accessing cooperative innovation performance to a fuller extent when taking current market conditions into account. Some scholars also hold that balancing ambidexterity to a moderate extent is conductive to improving firm performance, yet significant amounts of organizational resources will be consumed if there is over-engagement in the balance dimension of ambidexterity to the detriment of performance improvement, thus the relationship between the balance dimension of ambidexterity and innovation performance should be an inverted U-shape (Sun,

Dang, and Song, 2014). This paper contends that when there is relative balance, not only are firms able to avoid the risk of obsolescence, path dependencies, core rigidities or organizational inertia caused by putting too much knowledge and resources, such as time, energy, capital etc., into exploitation to the exclusion of exploration, but they are also able to avoid the risk of high-risk, low-return, blind and pointless investment resulting from an addiction to unlimited resource-exploration while failing to recognize the need to match exploitation. Only when there is relative balance can a virtuous circulation between exploration and exploitation be produced, improving innovative operational efficiency and contributing to the improvement of innovation performance. As a result, the following hypothesis is made:

H1. BD is significantly and positively related to the innovation performance of enterprises.

Differing from March (1991), who holds that there exists an ambidexterity paradox between explorative capacity and exploitative capacity, some scholars in recent years have suggested that explorative capacity and exploitative capacity mutually complement and facilitate each other. For instance, Osamu (2015) points out that the effects of exploitation on organizational performance complement the effects of exploration, and vice versa. On the other hand, the acts of exploitation complement the acts of exploration by enabling the latter, and vice versa. Eisenhardt and Martin (2000) maintain that bringing in new knowledge and technologies continuously, improving existing products and processes and enhancing the exploitative capacity of firms are needed for the development of explorative capacity. Gupta, Smith, and Shalley (2006) contend that both activities are not necessarily in conflict. Exploration and exploitation can enhance each other because they can take place in complementary domains, which do not necessary compete for the same resources. More interesting, there are also some scholars that have started to explore the relationship between CD and innovation performance, yet the conclusions reached have been inconsistent. Most scholars argue that the two capacities are able to make full use of each other's resources and advantages to improve themselves so as when there is a stronger explorative capacity (exploitative capacity), there will a bigger influence exerted by exploitative capacity (explorative capacity) on firm performance

(Zhan and Chen, 2013). For example, Katila and Ahuja (2002) suggest that there exists a feedback relationship between explorative capacity and exploitative capacity, and the interaction effects of the two are positively related to the exploration of new products. Liu et al. (2013) hold that the interaction effects of the two are positively related to organizational innovation. Nevertheless, there are also some researchers that believe that CD is negatively related to innovation performance (Atuahene and Murray, 2007). For example, Mladenka, Matej, and Ines (2015) contend that above and over their independent effects, through combining them into a single construct of organizational ambidexterity, this variable remains negatively and significantly related to innovation performance. Only when there is a higher level of BD can BD significantly influence innovation performance (Zhang, Li, and Yu, 2014). Also, BD can bring out distinct effects on innovation performance in different organizational contexts. For instance, Wei, Zhao, and Zhang (2014) believe that the interaction of exploitation and exploration has a negative effect on firm performance in a firm with a responsive market orientation whereas it has a positive effect on a firm with a proactive market orientation.

This paper holds that a high CD will enhance innovation performance. First, the functional complementation of exploration and exploitation contributes to the improvement of innovation performance. Resources released through successful exploitative activities can furnish future explorative activities (Bierly and Daly, 2007), while explorative innovation provides ideas for exploitation and thus facilitates a culture of innovation, which also supports exploitative innovation (Blindenbach and Ende, 2014). In other words, a high level of exploitation could internalize knowledge and resources discovered by exploration such as alternative choices, utilizations, new technologies, new markets etc., and could apply to organizational daily business and innovation activities so as to broaden the breadth and depth of knowledge, improve operational efficiencies, and ultimately promote innovation performance. High-level exploration could give a larger scope to innovational attempts, identify new market opportunities, look for innovation thinking and provide a knowledge basis for exploitative innovation activities. Second, risk complementation of exploration and exploitation contributes to the improvement of innovation performance. Explorative learning asks an organization to explore new knowledge and fields, break through existing thinking and dare to take risks (Mladenka, Matej, and Ines, 2015). Exploitative

study, on the other hand, could mobilize knowledge and resources within an organization, and decrease uncertainty and risks. Thus, the undertaking of risks contributes to the focus on innovation activities for an organization. Third, time complementation of exploration and exploitation contributes to the improvement of innovation performance. Products produced through explorative study cannot meet the needs of the market in a short time, while those produced through exploitative study can. As a consequence, it provides time for finding and choosing innovation methods. Finally, outcome complementation of exploration and exploitation contributes to the improvement of innovation performance. Exploitative study can obtain certainty returns within a certain time, while the results of explorative study are uncertainty, and with even more short-term costs. However, explorative study is able to provide the basis for enterprises to establish long-term competitive advantages (March, 1991; Shu, Hu, and Jiang, 1991). Thus, the return complementation between exploration and exploitation contributes to eliminating concerns of high investment and disproportionate returns so as to put more energy into innovation development. Exploration tends to be subject to radical innovation, while with exploitation it is easier to engage in incremental innovation. Therefore, the complementation of exploration and exploitation could bring the two innovation methods together. As a result, the following hypothesis is proposed:

H2. BD is significantly and positively related to innovation performance.

2.2 The Moderating Effect of Entrepreneurial Orientation

Contingency theory emphasizes that organizations vary according to internal and external conditions in management, and search for the most suitable management mode or method aimed at divergent specific conditions. Organizations, in high-tech industries full of competition, need to choose the most suitable strategic orientation in light of conditions inside and outside the organization so as to guide organizational behavior and finally enhance innovation performance. Strategic orientation reflects a firm's business philosophy rooted in a set of values that guides the firm to achieve competitive advantage (Gatignon and Xuereb, 1997). It defines the resource allocation motivation to address issues and offers answers to these issues with fit resource allocation patterns and processes.

Entrepreneurial orientation is an important strategic orientation.

The study of entrepreneurial orientation derives from an influence factors analysis of product innovation by Miller and Friesen (1982), which finds that discrepancies exist in product innovation between entrepreneurial and conservative firms. In following studies, entrepreneurial orientation is mainly used to reflect firms' strategic orientation or intensity and the tendency for engaging in entrepreneurial activity (Covin and Slevin, 1989). Entrepreneurial orientation alludes to the degree to which an organization is innovative, risk-taking and proactive (Covin and Slevin, 1989; Frishammar and Ake, 2007; Saeed, Yousafzai, and Engelen, 2014; Luu, 2016). Innovation refers to a focus on introducing new products, technologies and services by firms, and participating in innovative activities; risk-taking refers to firms confronted with uncertainty circumstances adopting bold actions that cast organizational resources into indeterminacy and venture; proactiveness refers to forward-looking firms developing new products, crafts or technologies ahead of competitors (Lumpkin and Dess, 1996).

The existing literature suggests that one of the necessary conditions needed for the achievement of CD is organizational resource adequacy (Zhou and Xue, 2009), and when there is low organizational resource adequacy, CD will not enhance firm performance (Yang, Li, Liang, and Li, 2011). Nevertheless, an entrepreneurial orientation is a contributor to firm success, as it is able to facilitate the acquisition of resources and customers' knowledge (Cai, Zhu, and Liu, 2011; Yin, 2013), the focus on exploring knowledge and capabilities (Guo, Wang, and Liu, 2013), and the exploitation of knowledge resources ahead of competitors (Zhou and Li, 2007). In addition, there are also findings that indicate that when a stronger entrepreneurial orientation exists, there is a stronger innovative motivation. As well, entrepreneurial orientation plays a positive moderating role between explorative learning and technological innovation as well as between exploitative learning and management innovation (Sun and Su, 2015). Entrepreneurial orientation strengthens the relationship between explorative innovation and firm performance (Gao, Gao, and Yang, 2010), and when faced with a new environment and new market, new ventures with a strong entrepreneurial orientation are inclined to look for information and knowledge inside and outside the firm to access new opportunities ahead of rivals as well as increase the investment in learning and R&D to carry out product and services

innovation (Malhotra, 1999). Meanwhile, an entrepreneurial orientation not only could bring out a stronger learning motivation and facilitate the generation of learning behavior, but also could further clarify a firm's learning direction and scope (Hackbarth, 1998; Turner and Makhija, 2006).

Therefore, this paper holds that, first, entrepreneurial orientation cushions the risk associated with an imbalanced pursuit of exploitation and exploration so as to improve innovation performance. As firms are competing for limited resources they are faced with a trade-off situation, either a "success trap" or a "failure trap" (March, 1991), situations where a firm decides to invest heavily in exploitation, has fewer resources available for exploration or vice versa (Stadler, Rajwani, and Karaba, 2014). As an entrepreneurial orientation contributes to acquiring customer knowledge and resources, thus an organization with an entrepreneurial orientation is more likely to possess larger pools of slack resources (Bourgeios, 1981; Chen and Hambrick, 1995) and is also likely to have resources dedicated to specialized departments that can help it respond to potentially damaging risks in a more timely and effective manner (Thompson, 1967) so as to improve innovation efficiency. Second, an entrepreneurial orientation supports knowledge exploration and acquisition, which helps knowledge accumulation within an organization. As well, knowledge accumulation makes up for the lack of knowledge needed for innovation exploitation (Thompson, 1967), provides a greater base for an organization to break through the bottleneck of existing resources and knowledge, reforms and improves existing products, introduces newer products and achieves higher innovation performance (Shu, Hu, and Jiang, 2015). Meanwhile, knowledge exploration could increase the breadth and depth of organizational knowledge, leave an organization with a deeper understanding of new knowledge, and identify potential changes (Bierly and Damanpour, 2009) to correctly assess the demands and trends in the products market for new innovations. Under these conditions, the innovation capacity of an organization becomes more mature, and thus contributes to enhancing innovation performance (Zahra and George, 2002). Hence, the following hypotheses are proposed:

H3a. The relationship between BD and innovation performance can be reinforced by high entrepreneurial orientation.
H3b. The relationship between CD and innovation performance can be reinforced by high entrepreneurial orientation.

Based on the above hypotheses, as shown in Figure 1, this paper proposes the following research framework:

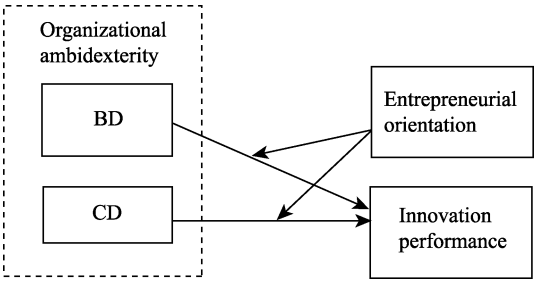

Figure 1 Research Model

3 Research Design

3.1 Sample and Data Collection

For this paper, we selected firms in high-tech industries in Beijing, Tianjin and Dalian, in the Bohai Economic Rim, and collected data through a large sample investigation. For the sample selection, fierce competition, rapid renewal technologies and the strong product innovation capacity of the high-tech industry were mainly taken into consideration. More data from firms with an entrepreneurial orientation is available relative to other industries, making high-tech an appropriate selection for this research. Questionnaires were filled in by senior managers of firms and middle managers with more than 3 years of working experience in strategic and technology departments. Because organizational ambidexterity, innovation performance and entrepreneurial orientation are all variables relevant to the strategic level of firms, so it is easier for senior managers to understand and master these issues. Questionnaires were delivered and returned in early June and the end of July respectively so that respondents had 2 months to complete them. We delivered a total of 500 questionnaires and received 192, from which we eliminated the questionnaires with more than 3 missed data points and the inconsistent ones. There were 175 effective questionnaires remaining with an effective response rate of 35.00%. We distributed the questionnaires in person, where they were filled out immediately, or by e-mail after receiving consent from the firms targeted for research. The questionnaires delivered by these two methods each accounted for approximately

50% of the returned total: 90 filled in on the spot and 85 received by e-mail out of the total 175 valid questionnaires. The specific distribution of the research sample is shown in Table 2.

Table 2 Sample Characteristic Distribution Table

	Sample information	Sample number	Percentage
Organization size	100–200	48	27.43%
	200–500	52	29.71%
	500–2000	37	21.14%
	Above 2000	38	21.71%
Organization age (year)	3–5	47	26.86%
	6–10	54	30.86%
	11–20	35	20.00%
	Above 20	39	22.29%
Industry	High-tech services	46	26.29%
	Electronic information technology	34	19.43%
	Pharmaceutical biotechnology	35	20.00%
	Other high-tech industries	60	34.29%
Position of respondents	Senior managers	152	86.85%
	Middle managers	23	13.15%

As shown in Table 2, firms of 100–200 employees account for 27.43%, 200–500 employees account for 29.71%, 500–2000 employees account for 21.14% and above 2000 employees account for 22.29%. The firms that are 3–5 years in age account for 26.86%, 6–10 years account for 30.86%, 11–20 years account for 20.00%, and above 20 years account for 22.29%. There are 4 industries covered by the study including high-tech services, electronic information technology, pharmaceutical biotechnology and other high-tech industries, accounting for 26.29%, 19.43%, 20.00% and 34.29% respectively. Overall, the sample structure is reasonable and suitable for empirical research.

Because of the short interval between questionnaire distribution and reception, there are no response bias questions. However, there may be common method bias as all the questions were answered by one respondent in the process of filling in the questionnaire, so in order to avoid this issue, we adopted the

approach of combining the program control method with a statistical control method. This research, in the process of designing the investigation questionnaire, improved the items of scale to try to make items clear and easy to understand, decreasing the guesswork of the respondents. The questionnaires were filled in anonymously, eliminating the psychological concerns of respondents. We tested for common method bias using the Harman single factor test. We performed exploratory factor analysis using all items. The first principal component accounted for 32.059% of the load which is well within the range of 20%–40% to indicate a relatively small of homologous bias. Therefore common method bias is not a serious problem in the questionnaire measurement of this study.

3.2 Variables Measurement

In terms of the measurement of explorative capacity and exploitative capacity, He and Wong (2004) employ 4 items to measure explorative innovation: introducing a new generation of products, expanding the range of products, exploring new markets and entering new technology areas, and use 4 items to measure explorative innovation: improving the quality of existing products, enhancing the flexibility of products, cutting the cost of products and increasing production and reducing the consumption of raw materials. Chandrasekaran, Linderman, and Schroeder (2012) use the scale developed by He and Wong as a reference and employ 3 items to measure explorative capacity-introducing a new generation of products, entering a new technology area and the capacity to open new markets-and 4 items to measure exploitative capacity- using business units to expand the new products' range compared with the average level of industry, refinement of existing quality and flexibility, and the capacity to reduce costs-which have proved to have high reliability and validity. This paper adopts the scale of Chandrasekaran, Linderman, and Schroeder making some appropriate adjustments in how the items are expressed according to the research needs (changes in expression but no change in mean), which employs 3 items to measure explorative capacity and 4 items to measure exploitative capacity. With respect to the measurement of BD, some scholars deploy the differential method, which uses the absolute difference between explorative capacity and exploitative

capacity to measure imbalance (e.g., Li and Si, 2008). Wang, Chen, and Yang (2012) put forward a viewpoint of organic balance. They argue that the approach of adopting difference to measure balance is a mechanical balance viewpoint since the multiplying measurement approach stands for interactive effect rather than imbalance. The expression of organic balance is $1-|x-y|/(x+y)$, wherein x represents explorative capacity, while y represents exploitative capability. Zhang, Li, and Yu (2014) use the above method of organic balance to measure BD as well. Cao et al., and Jiao leverage a maximum value of 7 minus the absolute difference between exploitative capacity and explorative capacity to measure BD. The method of Cao et al. (2009) is used in this paper to measure BD. Nevertheless, with regard to the measurement of CD, there is a relatively broad consensus in academia to use the product between explorative capacity and exploitative capacity to measure CD (He and Wong, 2004; Jiao, 2011; Saeed, Yousafzai, and Engelen, 2014; Cao, Gedajlovic, and Zhang, 2009). Therefore, we employ this method to measure CD. With respect to the measurement of entrepreneurial orientation, we follow Covin and Slevin's (2009) classic 3 dimensions (innovative, risk-taking and proactiveness) scale of 9 items, which has proven to have high reliability and validity verified by scholars at home and abroad. In terms of the measurement of innovation performance, there are two approaches, objective and subjective. The number of patents applied for by firms, the usage number of R&D projects, the annual number of valid invention patents and new product sales are more likely to be used for objective measurement. The subjective measurement method of scale has also been used by some scholars to measure innovation performance, for instance, Li, Yao, and Wang (2010), in studying the relationship between entrepreneurial orientation and firm performance, employ a 4-item scale which has good reliability and validity to measure innovation performance including new products or new services that meet the expected customer value and sales targets; new products or new services that meet the expected market share targets; new products or new services that meet the expected profit targets; and, new products or new services that meet the expected sales growth targets. We adopt this scale to measure innovation performance.

This paper selects organization size, organization age and industry type as

control variables. Organization size pertains to the amount of resources a firm possesses or may readily access. Organization size moderates the relationship between BD and firm performance (high BD is more beneficial for smaller firms), so we control it and use employee numbers to represent it. Meanwhile, we control organization age and industry type as well. Long-established organizations tend to be in a mature period, so the firms have more resources, more mature experiences and institutions to balance explorative capacity and exploitative capacity. Organization age is calculated in this study from when the firm was established to 2015. Among the four industry types discussed in this paper, high-tech services (e. g., software services), electronic information technology and pharmaceutical biotechnology belong to high-tech industries as defined by National Bureau of Statistics (NBS), and they are also consistent with the common classification criteria in the literature (e. g., Detienne and Koberg, 2002; Wei, Yi, and Guo, 2014). Therefore, this paper encodes these 3 sectors as "1" and the other industries as "0." The sampling site is located in the economically developed areas of Bohai.

3.3 Reliability and Validity

The exploratory factor analysis of the organizational ambidexterity scale shows that the KMO test value, done to determine whether the sample size is sufficient, is 0.745, above the threshold of 0.7, exceeding the sample's constraint condition for factor analysis. The Bartlett sphere test value, which tests the relative association degree among items, is 703.727 (df=21, $p < 0.001$), demonstrating that items are mutually correlated and suitable for the extraction of common factors. Employing principal component analysis, we analyze two public factors—explorative capacity and exploitative capacity—with variability at 44.362% and 29.935% respectively, and the cumulative interpreted variation for the scale is 74.297%. The reliability coefficients of the two extracted factors are 0.699% and 0.851% respectively, above the minimum threshold of 0.6 suggested by relevant research, indicating a high reliability. Through a factor analysis of the 7 items of the organizational ambidexterity scale, we find that the eigenvalue is above 1, the minimum factor load value is 0.748, the maximum factor load value

Table 3 Exploratory Factor Analysis

Variable	Dimension	Measure index	Load factor	Explained variance
Organizational ambidexterity Cronbach's α=0.788	Explorative capacity Cronbach's α=0.699	Compared with the average level of industry, we have strong capabilities to introduce a new generation product	0.834	74.297
		Compared with the average level of industry, we have strong capabilities to enter a new technology area	0.774	
		Compared with the average level of industry, we have strong capabilities to develop new markets	0.748	
	Exploitative capacity Cronbach's α=0.851	Compared with the average level of industry, we have strong capabilities to expand product range	0.899	
		Compared with the average level of industry, we have strong capabilities to refine product quality	0.806	
		Compared with the average level of industry, we have strong capabilities to increase flexibility	0.802	
		Compared with the average level of industry, we have strong capabilities to reduce the cost	0.794	
Entrepreneurial Orientation Cronbach's α=0.944	Innovation Cronbach's α=0.985	In the past 3 years, the firm has made big changes aiming at the existing combination of products and services	0.893	90.004
		In the past 3 years, the firm has produced many new products/services	0.883	
		The firm attaches great importance to R & D projects, seeking advanced and innovative technologies and services	0.877	
	Risk-taking Cronbach's α=0.960	The firm prefers bold and rapid behaviors	0.850	
		The managers of the firm prefer projects with high risk and the possibility of high returns	0.836	

(*To be continued*)

(*Continued*)

Variable	Dimension	Measure index	Load factor	Explained variance
Entrepreneurial Orientation Cronbach's α=0.944	Proactivness Cronbach's α=0.835	When facing uncertainty, the firm tends to take positive action to seize opportunities	0.804	
		The firm always launches competitive behavior ahead of competitors, and competitors are forced to respond.	0.914	
		The managers of the firm attach great importance to introducing new products and ideas prior to other competitors in the industry	0.801	
		The firm always takes precedence in introducing new products, services, new management skills and production technologies	0.571	
Cronbach's α=0.868	Cronbach's α=0.868	New products or new services reach the expected customer value and sales target	0.708	73.234
		New products or new services reach the expected market share target	0.905	
		New products or new services reach the expected profit target	0.898	
		New products or new services reach expected sales growth target	0.895	

is 0.899, and each load value is above 0.5 on average, so the scale has a high validity. The exploratory factor analysis of entrepreneurial orientation suggests that the KMO test value is 0.889 exceeding the sample's factor analysis constraint condition. The Bartlett sphere test value is 2094.529 (df = 36, $p < 0.001$), which is suitable for the extraction of common factors. There are 3 public factors—innovative, proactiveness and risk-taking—analyzed, explaining the variabilities of 35.592%, 30.436% and 23.975% respectively, and the cumulative interpreted variation for the scale is 90.004%. The reliability coefficients of the 3 extracted factors are 0.985%, 0.960 and 0.835% respectively, indicating a high reliability. The factor analysis of the 9 items of entrepreneurial orientation show an eigenvalue above 1.0, a minimum factor load value of 0.571, a maximum factor load value of 0.914, and each load value is above 0.5 on average, so the scale has a high validity. The exploratory factor analysis of innovation performance suggests that the KMO test value is 0.816 exceeding the sample's factor analysis constraint condition which indicates that the sample is sufficient. The Bartlett sphere test value is 402.856 (df = 6, $p<0.001$, demonstrating all items are mutually correlated and suitable for the extraction of common factors. There is one public factor—innovation performance—analyzed which explains the variability of 73.234%. The reliability coefficient of this factor is 0.868, indicating a high reliability. The factor analysis of the 4 items of innovation performance shows the eigenvalue is above 1.0, the factor load value is 0.708, the maximum factor load value is 0.905, and each load value is above 0.5 on average, so the scale has a high validity.

4 Empirical Analysis

This paper carries out correlation analysis and regression analysis for the data collected through a large sample questionnaire survey using SPSS21.0 statistical analysis software and analyzes the relationship among variables systematically so as to test hypotheses.

4.1 Correlation Analysis

The relationship of variables is shown in Table 4. Explorative capacity,

exploitative capacity and innovation performance are significantly related and suitable for regression analysis. The relationship between entrepreneurial orientation and innovation performance is found to be non-significant, giving us an idea of what is suitable for moderating effect analysis. The correlation between control variables of organization size, organization age, industry type and innovation performance are insignificant yet the coefficients are all positive, which provide a strong preliminary indication that the longer-established firms and the bigger firms have better innovation performance.

Table 4 Correlation Analysis

	Mean value	Standard deviation	1	2	3	4	5	6
Organization size	2.37	1.106	1					
Organization age	2.38	1.107	0.406**	1				
Industry type	2.62	1.206	−0.071	0.064	1			
Explorative capacity	5.76	1.051	0.125	0.052	0.011	1		
Exploitative capacity	4.97	1.368	0.074	0.055	−0.104	0.285**	1	
Entrepreneurial orientation	5.94	1.181	−0.054	−0.027	−0.061	0.060	−0.032	1
Innovation performance	4.88	1.179	0.148	0.129	0.082	0.499**	0.538**	−0.020

Notes. ** indicates a significant correlation at the 0.01 level (bilateral), * indicates a significant correlation at the 0.05 level (bilateral).

4.2 Regression Analysis

Table 5 reports the regression analysis results of BD and CD affecting innovation performance.

In Table 5, M1 is a regression model of 3 control variables of organization size, organization age and industry type to innovation performance. M2 and M3 are regression models of BD and CD to innovation performance respectively. M4 and M5 are regression models with the addition of moderating variables. From the F values of M1–M5, we can see that, in addition to M1 (only control variables), all models show significance.

Table 5 Hierarchical Regression

Variable	Dependent variable: Innovation performance				
	M1	M2	M3	M4	M5
Organization size	0.133	0.029	0.071	0.056	0.065
Organization age	0.077	0.001	−0.029	−0.015	−0.029
Industry type	0.084	0.076	0.120**	0.092**	0.111**
Explorative capacity			−0.035		−0.028
Exploitative capacity			0.411***		0.402***
BD		1.045***		0.997***	
CD			0.554***		0.560***
Entrepreneurial orientation				−0.033	−0.103**
BD* Entrepreneurial orientation				0.241***	
CD* Entrepreneurial orientation					0.014
R^2	0.035	0.776	0.789	0.805	0.799
Adjusted R^2	0.018	0.771	0.781	0.798	0.789
F	2.058	147.416***	104.457***	115.238***	82.510***

Notes. *indicates $p < 0.05$, * * indicates $p < 0.01$, * * * indicates $p < 0.001$.

From Table 5 we can see that the influence of organization size and organization age on innovation performance are insignificant. As well, industry type is not significant in M1 and M2, but is significant in other models. This may be because R&D activities, stocks of knowledge, organizational learning and an organizational innovation atmosphere all contribute to the absolute absorption capacity positively, in which the influence of R&D activities and stocks of knowledge are extremely significant (Ma, Tian, and Shi, 2014). Thus, there is a relatively strong absorption capacity in high-tech industries with high innovation. However, when there is less knowledge acquisition, organizations with low absorption capacity are able to put the small amount of knowledge they have into application quickly, while the organizations with high absorption capacity translate knowledge into innovation performance slowly as a result of internalization needs. With increased levels of acquisition of organizational knowledge, organizations with low absorption capacity are confronted with difficulties in transforming knowledge and identifying difficulties because of the large amount of knowledge; therefore, innovation performance begins to lag

behind organizations with high absorption capacity (Shu, Hu, and Jiang, 2015). The results of M2 suggest that, after controlling for organization size, organization age, and industry type, the regression coefficient between BD and innovation performance is 1.045, and the significance level value of t is 0.000 ($p < 0.001$), which shows that the higher BD is, the better innovation performance becomes. Therefore, H1 is supported. The regression analysis results for M3 show that the regression coefficient between CD and innovation performance is 0.554, and the significance level value of t is 0.000 ($p < 0.001$), indicating that the higher CD is, the better innovation performance becomes. Therefore, H2 is supported as well. However, we noticed that the coefficient between exploration capacity and innovation performance is negative and insignificant (β=−0.035), which seems inconsistent with actual conditions. By consulting the literature, we find that the relationship between explorative capacity and innovation performance is expressed as an inverted U-shape (Yucheng and Peter, 2014). As a consequence, we tested its quadratic term and the regression results show that the coefficient of the quadratic term is negative (β=−0.106), explaining why the exploitative capacity coefficient is negative in M3 and M5 (the first term is only the measurement of the right part of the inverted U-shape, and the reason why it is significant is that the sample data is mostly distributed on the right part of the inverted U-shape which we can see clearly in a scatterplot).

M4 adds the interactive effects between BD and entrepreneurial orientation to M2, in which the relationship between BD and innovation performance is positively moderated by entrepreneurial orientation (β=0.241, $p < 0.001$). The values of R^2 in M2 and M4 go from 0.776 to 0.805 and ΔR^2 is 2.9%, suggesting that the explanatory power of M4 is more than M2. Thus, H3a is supported. M5 is the model where the interactive effect between CD and entrepreneurial orientation is added to M3, in which the relationship between CD and innovation performance is positively moderated by entrepreneurial orientation(β=0.014)but not significant. This may be because even though the imbalance is caused by entrepreneurial orientation, but owing to the existence of the interactive effect between explorative capacity and exploitative capacity, there is no significant change to this interactive effect caused by imbalance under the moderating effect of entrepreneurial orientation. In spite of this, its regression coefficient is positive, thus there are always certain practical implications. The values of R^2 in M3 and M5 go from 0.789 to 0.799 and ΔR^2 is 1.0%, indicating that the explanatory

power of M5 is more than M3. Thus, H3b is partly supported. The reason for this may be because, in firms, the effects of resource acquisition on organizational ambidexterity can be described as an inverted U-shape (Yu and Peter, 2014), while CD is more conducive to resource-constrained firms (Cao, Gedajlovic, and Zhang, 2009). As a consequence, when acquiring a great pool of resources under the effect of entrepreneurial orientation and located in the right part of the inverted U-shape, the effects of organizational ambidexterity on innovation performance may be suppressed.

5 Conclusions and Implications

5.1 Conclusions

This paper firstly, on the basis of the literature and theory deduction, constructs a research model of the relationship between organizational ambidexterity and innovation performance. Then using existing mature scales to design an investigation questionnaire and adapting a big sample questionnaire investigation, we gather data. Finally, the following conclusions are drawn after empirical analysis was conducted using SPSS 21.0 statistics software：

(1) BD and CD are all significantly positively related to innovation performance. Lin, Yang, and Demirkan (2007) find that enterprises in increasingly dynamic environments are more in need of balancing explorative alliances and exploitative alliances, the former bringing in heterogeneous knowledge for enterprises, while the latter allows enterprises to form specific capacities and identities. This is consistent with our paper's findings that BD is more beneficial to the improvement of innovation performance compared with the imbalance of organizational ambidexterity, and a higher BD is more in favor of enhancing innovation performance relative to lower BD. Such research results are consistent with the hypotheses, suggesting that, compared with firms possessing a single capacity only, the simultaneous pursuit of explorative capacity and exploitative capacity and balancing the two will increase innovation performance and enhance the competitiveness of firms. Meanwhile, the findings show that there is a significant and positive correlation between CD and a firm's innovation performance, which is in line with the hypotheses, indicating that in employing new technologies and knowledge, a firm is capable of promoting the improvement of existing products and processes so as to enhance exploitative

capacity. Klingebiel and Rammer (2014) hold that the combined dimension of innovation ambidexterity enables organizations to take advantage of more opportunities for explorative innovation as well as exploitative innovation, thereby increasing the likelihood of enjoying successful results. Conversely, making full use of existing knowledge and technologies continuously enables firms to strengthen the understanding of new knowledge and resources and explore new areas more effectively so as to contribute to the development of explorative capacity. As noted, a firm's explorative capacity and exploitative capacity can complement each other and both can provide enhancement of innovation performance.

(2) The relationships between BD and CD and innovation performance are all positively moderated by entrepreneurial orientation. Knowledge acquisition is the key factor effecting innovation performance, while entrepreneurial orientation is a contributor to seeking customer knowledge and resources. Thus entrepreneurial orientation could exert influence on the relationship between organizational ambidexterity and innovation performance (Shu, Hu, and Jang, 2015). Firstly, the positive moderating effect of entrepreneurial orientation on the relationship between BD and innovation performance is significant. Consistent with the hypotheses that suggest that entrepreneurial orientation, acting as strategic orientation characterized by innovation, risk-taking and proactiveness, not only provides a positive promoting effect for the acquisition of firm resources as well as helps firms obtain resources and customer knowledge, but also creates innovative atmospheres for firms that further leads to improving the level and degree of BD. Secondly, even though there is a positive moderating effect of entrepreneurial orientation on the relationship between CD and innovation performance but it is not significant, which is not in line with the hypotheses. This may be because when organizational ambidexterity takes place irrespective of whether entrepreneurial orientation exists, the complementary effects are already there, resulting in an insignificant moderating effect.

The main theoretical contribution of this paper is that it proves empirically that in competitive high-tech industries, BD and CD are all significantly and positively related to a firm's innovation performance while the unique environmental factor of the high-tech industry has not been taken sufficiently into consideration in prior studies. Meanwhile, this paper also shows that in competitive high-tech industries, a firm's entrepreneurial orientation exerts a

positive moderating effect on the relationship between organizational ambidexterity and innovation performance.

5.2 Management Implications

(1) BD imposes a positive promoting effect on the improvement of a firm's innovation performance. Firms ought to attach importance to the balance dimension of organizational ambidexterity in practice and try to avoid the "failure trap" caused by over-engagement in explorative capacity or the "success trap" resulting from over-commitment to exploitative capacity. This is to say, firms not only need to strengthen the improvement of existing crafts, processes and technologies, but also need to explore new crafts, processes and technologies, maintaining both short-term innovation performance and enhancing long-term competitive advantages. Meanwhile, the improvements of the two capacities and the maintenance of high-level organizational ambidexterity balance are also needed in order to guarantee the positive effects for a firm's innovation growth.

(2) BD contributes to the improvement of a firm's innovation performance. Earlier research ignores the complementary character of organizational ambidexterity; however, this study shows that CD is positively and significantly related to innovation performance in firms in the high-tech industry. Even though the reasons why these conclusions are applicable to the high-tech industry are not addressed in this paper (preliminary speculation is that an organic structure or network structure creates conditions for the combined dimension of organizational ambidexterity), yet this result indicates that the nurture and improvement of organizational ambidexterity can be pursued boldly by high-tech firms.

(3) The positive moderating effect of entrepreneurial orientation on the relationship between organizational ambidexterity and innovation performance indicates that the achievement of innovation and growth by high-tech firms in a highly uncertain competitive environment requires promoting entrepreneurial orientation, making efforts to acquire resources, and creating an innovation atmosphere so as to create conditions for exerting the influence of organizational ambidexterity effectively.

5.3 Research Limitation

The sample employed in this paper is mainly selected from high-tech firms in Beijing, Tianjin and Dalian in the Bohai Economic Rim area. Thus, the research results may not be universal and research in the future can further expand the geographic coverage and industry coverage of the sample. Only mature high-tech firms were chosen for our sample, so the applicability of the results to new ventures need to be tested. The data obtained in this research are cross-sectional. The research results may not mirror the relationship among various variables in the growth process of a firm. Therefore, a time series study can be adopted for further research.

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