

Organizational Learning Ambidexterity, Strategic Flexibility, and New Product Development*

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Although organizational ambidexterity has gained momentum in recent innovation research, previous literature still offers a confusing and partial picture about how to leverage ambidexterity for new product development because of two limitations. First, previous research mainly focuses on static resource endowment and thus offers little insight about how firms should dynamically reconfigure resource portfolios to leverage organizational ambidexterity. Second, conceptual confusion on the notion of the balance dimension of organization ambidexterity still exists.

This study seeks to explore how firms should dynamically reconfigure resource portfolios to leverage organizational ambidexterity for new product development and to bring greater conceptual clarity to the notion of balance. By extending the static resource assumption, which is central to the extant debate in organizational ambidexterity literature, this research unpacks ambidexterity into a relative exploratory dimension and an interactive dimension. We further investigated the moderating effect of resource flexibility and coordination flexibility on the impacts of the two dimensions on new product development performance.

Based on the dynamic resource management view and organizational learning theory, we proposed six hypotheses and collected data from 213 firms through a survey to examine the hypotheses. Our results indicate that relative exploratory dimension and interactive dimension have different effects on new product development. Specifically, the relative exploratory dimension has an inverse U-shaped effect on new product development while the interactive dimension has a positive effect. Furthermore, we find that resource flexibility and coordination flexibility have positive moderating effects on the relationships between the two dimensions of ambidexterity and new product development performance. Our study contributes to the ambidexterity research in three ways. First, from a dynamic resource management view, this study extends previous ambidexterity research from a static view to a dynamic view by exploring the moderating effects of resource flexibility and coordination flexibility. Second, we extend the understanding on ambidexterity by bringing greater conceptual clarity to the notion of balance. Third, this research provides new evidence on the effects of ambidextrous learning on new product development performance in transition economy such as China, where ambidextrous learning is crucial for firms to adapt to a dynamic environment.

Introduction

Since the seminal work of March (1991), organizational ambidexterity has gained momentum in innovation research, which suggests that the superior innovation performance is expected by simultaneously performing both exploitative and explorative learning (Andriopoulos and Lewis, 2008; Cao, Gedajlovic, and Zhang, 2009; Gibson and Birkinshaw, 2004; He and Wong, 2004; March, 1991; Tushman and

O'Reilly, 1996; Yalcinkaya, Calantone, and Griffith, 2007). Especially in a transition economy, where the product life cycle is shortening fast and the environment is highly turbulent (Hoskisson, Eden, Lau, and Wright, 2000; Li, Su, and Liu, 2010; Sheng, Zhou, and Li, 2011; Wright, Igor, Hoskisson, and Peng, 2005), the ambidexterity rather than punctuated equilibrium or temporal cycling between long periods of exploitation and short bursts of exploration is a more viable option (Gupta, Smith, and Shalley, 2006; Jansen, Van den Bosch, and Volberda, 2006; Simsek, Heavey, and Veiga, 2009; Wang and Li, 2008).

Albeit the consensus, two perspectives conflict with each other directly on the incompatible or complementary logic of exploration and exploitation and also how to integrate them for innovation. One stream of literature mainly focuses on the difficulties in achieving

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ambidexterity and argues that exploratory learning and exploitative learning are fundamentally incompatible because they compete for scarce organizational resources (Auh and Menguc, 2005; Sidhu, Commandeur, and Volberda, 2007; Smith and Tushman, 2005; Uotila, Maula, and Keil, 2009). Therefore, this stream of literature views exploration and exploitation as two ends of one continuum and argues that firms should find the optimal relative exploratory point along the continuum. Alternatively, the other stream of literature mainly focuses on their potential complementary effects and argues that firms should perform higher combined levels of both exploration and exploitation to leverage their complementarities (Andriopoulos and Lewis, 2008; Birkinshaw and Gibson, 2004; Katila and Ahuja, 2002; Simsek et al., 2009; Yalcinkaya et al., 2007). New advances in ambidexterity research unpacks it into balance and combined dimensions to resolve this paradox and suggests that the balance dimension is more beneficial to resource-constrained firms, whereas the combined dimension is more beneficial to firms having greater access to internal and/or external resources (Cao et al., 2009; He and Wong, 2004).

Despite the above insightful contributions, the previous research still offers a confusing and partial picture about how to leverage ambidexterity for new product development because of two limitations. First, previous research offers little insight about how firms should dynamically reconfigure resource portfolios to leverage organizational ambidexterity. The incompatible view

only focuses on static resource endowment with the assumption of resource scarcity. However, this assumption is not always true when considering dynamic resources management. The dynamic resources management view suggests that resource portfolios can be extended by accumulating multifunctional resources and reconfiguring resource bundles (Sanchez, 1995; Sirmon, Hitt, and Ireland, 2007; Sirmon, Hitt, Ireland, and Gilbert, 2011). Therefore, the validity of the incompatible view may be contingent on the firms' resource dynamic management capabilities. Furthermore, the complementary view is mainly silent on the resource management issues while resource aligning capabilities are crucial to achieve the complementary effects (Jansen, Tempelaar, and Van den Bosch, 2009; Sirmon et al., 2007).

Second, the conceptual confusion on the notion of the balance dimension still exists. Although some literature argues that the notion of balance means the extent to which the exploitation and exploration are equal (Cao et al., 2009; He and Wong, 2004), other literature contends that the notion of balance means high (low) exploitation needs to be coupled with low (high) exploration (Atuahene-Gima and Murray, 2007; Benner and Tushman, 2003; Nerkar, 2003). However, the dynamic resources management view suggests that the optimal relative level of exploration and exploitation may be contingent on the resource management capabilities (Sirmon et al., 2011), which has attracted little research attention.

This study seeks to explore how firms should dynamically reconfigure resource portfolios to leverage learning ambidexterity for new product development and to bring greater conceptual clarity to the notion of balance. Specifically, this article unpacks ambidexterity into a relative exploratory dimension and an interactive dimension and explores the moderating effects of resource flexibility and coordination flexibility on the impacts of two dimensions on new product development performance.

This research bears three contributions to the literature on ambidexterity. First, based on the dynamic resource management view, this article extends previous ambidexterity research from a static view to a dynamic view by exploring the moderating effects of resource flexibility and coordination flexibility. This article suggests that dynamic resource management capabilities should be built to leverage the organizational ambidexterity for new product development. The results indicate that the optimal way to structure exploitation and exploration and also their complementary effects are contingent on the level of resource flexibility and coordination flexibility. Second, this article extends our understanding on ambidexterity by bringing greater conceptual clarity to the

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notion of balance. This article argues that the optimal balance point along the continuum from exploitation to exploration is contingent on the level of resource flexibility and coordination flexibility. Third, this research provides new evidence on the effects of ambidextrous learning on new product development performance in a transition economy, where ambidextrous learning is crucial for firms to adapt to a dynamic environment.

Theoretical Background

According to organizational learning theory, both exploitative and exploratory learning are crucial for new product development (Atuahene-Gima and Murray, 2007). Exploitative learning refers to the learning activities in the neighborhood of a firm's current product-market knowledge base for the refinement and extension of existing competences, technologies, and paradigms, whereas exploratory learning refers to the learning activities beyond current product-market knowledge base for experimentation with new alternatives (Atuahene-Gima and Murray, 2007; Katila and Ahuja, 2002; March, 1991).

Firms may employ exploitation and exploration to achieve persistent success through ambidexterity (Benner and Tushman, 2003) or punctuated equilibrium (Burgelman, 2002; Gupta et al., 2006). Through ambidexterity, firms simultaneously perform exploration and exploitation while punctuated equilibrium refers to the temporal cycling between long periods of exploitation and short bursts of exploration (Gupta et al., 2006). Previous literature suggests the appropriateness of each mechanism may be a function of environmental and organizational context (Gupta et al., 2006). As environment dynamism increases and the pace of change accelerates, the firms need to renew their knowledge base by exploitative learning and simultaneously exploring new knowledge bases through explorative learning (Floyd and Lane, 2000; Gibson and Birkinshaw, 2004; He and Wong, 2004; Jansen et al., 2006). In a dynamic environment, a punctuated equilibrium mechanism may delay the adapting speed and miss the opportunities to explore new knowledge in time. In a transition economy such as China, firms are facing a dynamic environment, and the new knowledge updating is fast (Hoskisson et al., 2000; Li, Wei, and Liu, 2010; Sheng et al., 2011; Wright et al., 2005). In order to master both adaptability and alignment, firms should conduct exploitative learning to exploit existing knowledge and simultaneously perform exploratory learning to explore new knowledge.

Organizational Ambidexterity: Exploitation versus Exploration Paradox

The exploitation and exploration form a paradox that inspires great research debate. The paradox refers to contradictory yet interrelated elements that exist simultaneously and persist over time (Smith and Lewis, 2011). First, from the perspective of resource scarcity, March (1991, 1996, 2006) clearly argues that exploration and exploitation are fundamentally incompatible because they compete for scarce organizational resources. Therefore, firms should dynamically balance the relative level of exploration to exploitation in order to optimally distribute the scarce resources. Second, from the perspective of absorptive capacity, other researchers debate that exploration and exploitation may complement with each other by forming a dynamic learning cycle (Katila and Ahuja, 2002). Therefore, firms should engage in high levels of both activities simultaneously to leverage their complementarities (Birkinshaw and Gibson, 2004; Gupta et al., 2006; Simsek et al., 2009).

Although two debating views dominate the ambidexterity research, neither offers the whole picture of the reality. From the paradox perspective, exploration and exploitation are contradictory yet interrelated. The incompatible view mainly describes their organizational tension, whereas the complementary view mainly describes their complementary aspects. Research on yin-yang also suggests that a firm's sustainable development relies on a holistic problem-solving approach that embraces two lines of efforts for sustainable profitability (Chen, 2002; Smith and Lewis, 2011). First, firms should appropriately and dynamically balance the relative level of exploration and exploitation to find the optimal structure. Second, firms should align exploitation and exploration to achieve complementary effects (Chen, 2002; Smith and Lewis, 2011). Therefore, this article unpacks organizational learning ambidexterity into a relative exploratory dimension and an interactive dimension. The relative exploratory dimension pertains to the efforts to balance the relative magnitude of exploration and exploitation, whereas the interactive dimension pertains to the efforts to increase their complementary effects. The relative exploratory dimension contributes to innovation by the structured control of both obsolescence risks of over-exploitation and the risk of failing to appropriate returns from its costly exportation (Cao et al., 2009; March, 1991). The interactive dimension enhances innovation through generation of a greater pool of complementary resources and forming a dynamic path of absorptive capacity (Cao et al., 2009; Katila and Ahuja, 2002).

Dynamic Resource Management View and Strategic Flexibility

Until now, previous research offered little insight about how firms should dynamically reconfigure resource portfolios to leverage organizational ambidexterity. March (1991, 1996, 2006) only built the incompatible view on resource scarcity assumption, and the complementary view is mainly silent on the resource management issue while resource aligning capabilities are crucial to achieve complementary effects. Cao et al. (2009) only focused on the resource accessibility by investigating the moderating effects of firm size and environment munificence. However, Alvarez and Barney (2007) suggest that what is important is how firms create heterogeneous resources rather than the resource endowment. More research attention should be paid to explore how to dynamically structure, bundle, and leverage scarce resources to create value (Sirmon, Cove, and Hitt, 2008; Sirmon et al., 2007, 2011).

From the dynamic resource management perspective rather than static resource endowment view, the resource scarcity assumption that is central to the incompatible view may be relaxed. According to the dynamic resource management view, firms create value by structuring, bundling, and leveraging resource portfolios. Therefore, the resource portfolio may be extended by acquiring new resources, accumulating or developing resources internally, and creating new resource bundles. If so, the effects of balancing efforts may be contingent on the firms' capabilities to extend the resource portfolio. More importantly, the optimal point may change along with the dynamic capabilities to extend the resource portfolio and not necessary is the point where exploration is equal to exploitation. Furthermore, the dynamic resource management view also brings new insight on the complementary view. Firms should bundle resources to achieve the complementary effects of exploratory learning and exploitative learning because of their own distinguishing features. Therefore, dynamic resource management capabilities should also moderate effects of the interactive dimension of organizational learning ambidexterity.

Research on strategic flexibility suggests that firms may dynamically manage resources to adapt to a dynamic environment by building resource flexibility and coordination flexibility (Gerwin, 1993; Sanchez, 1995; Zhou and Wu, 2010). Resource flexibility refers to the capabilities to accumulate flexible resources with multiple uses, whereas coordination flexibility refers to the capabilities to create new resource combinations through an internal coordination process (Sanchez, 1995). Strategic flexibil-

ity is one of the important approaches to adapt to a dynamic environment in emerging countries such as China, where the external resource munificence is low (Liu, Li, and Wei, 2009). Resource flexibility broadens the choice scope of scarce resources, and coordination flexibility can leverage scarce resources to create a synergistic effect and/or create new resource combinations to match ambidextrous learning (Eisenhardt and Martin, 2000; Helfat et al., 2007; Teece, Pisano, and Shuen, 1997; Zhou and Wu, 2010). Therefore, as dynamic resource management capabilities, resource flexibility and coordination flexibility may moderate the effects of learning ambidexterity on new product development performance. Based on the above discussion, this research develops a framework as shown in Figure 1.

Hypothesis Development

The Relative Exploratory Dimension and New Product Development

The relative exploratory dimension indicates the efforts to avoid overemphasis on exploitation at the expense of exploration. Exploitation can improve firm efficiency by building on and replicating prior technological, product market knowledge, and manufacturing experience (Atuahene-Gima and Murray, 2007; Kim and Atuahene-Gima, 2010; March, 1991). However, self-reinforcing exploitation often leads to a "success trap" in single-loop learning, local search, or evolutionary learning (Katila and Ahuja, 2002; Levinthal and March, 1993; March, 1991). Therefore, overemphasis on exploitation may foster inertia, reduce adaptability to new opportunities, and reduce new product development (Cao et al., 2009; Gibson and Birkinshaw, 2004; Hannan and Freeman, 1984). When exploitation is much higher than exploration, firms may enjoy short-term success while being reluctant to upgrade product design in the face of significant technological and market change. Therefore, the overemphasis on exploitation may impede new product development (Christensen, 1997).

On the contrary, exploratory learning internalizes more new knowledge such as potential customer demand, new technology, or new market information, which enables firms to develop new products (Atuahene-Gima and Murray, 2007; Katila and Ahuja, 2002; Kim and Atuahene-Gima, 2010; March, 1991). Exploratory learning may deepen the understanding of future trends of technology, market competition, and also the potential demand (Cao et al., 2009; Katila and Ahuja, 2002). However, when exploration is too high, its positive

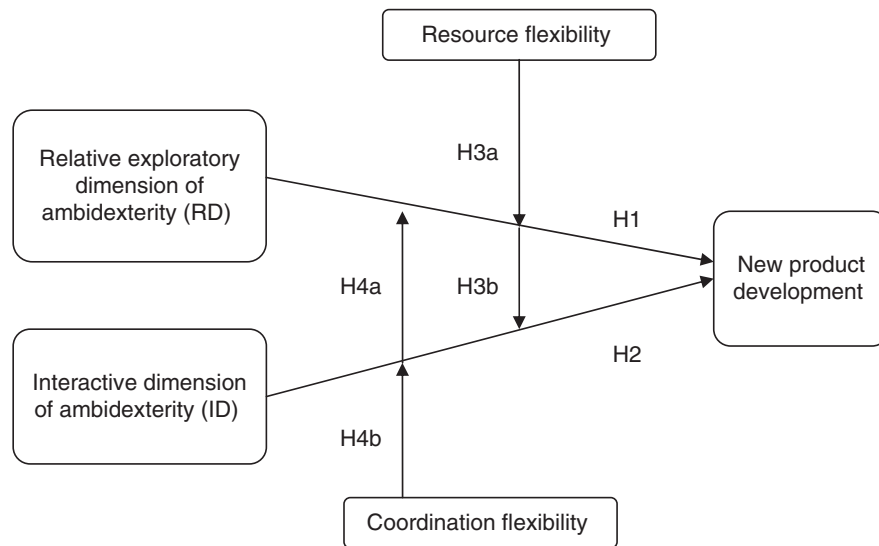


Figure 1. Conceptual Model

effects can be decreased because of the increasing difficulties to integrate too much new knowledge during the new product development process (Katila and Ahuja, 2002; Levinthal and March, 1993). First, too much new knowledge costs more to integrate. The great amount of new ideas is too complicated to coordinate, which hurts new product development efficiency (Katila and Ahuja, 2002; Laursen and Salter, 2006). Second, too high a level of exploration may lead to the development of brand-new product features that are incompatible with customers' needs (Atuahene-Gima and Murray, 2007). Therefore, when exploratory learning is much higher than exploitative learning, its marginal benefits may decline because of the increasing marginal cost and risk. Therefore, only the moderate level of relative exploratory dimension may help firms acquire new knowledge and also reduce the risk of instability and high cost in the new product development process. Therefore, it is hypothesized:

H1: Relative exploratory dimension has an inverse U-shaped effect on new product development performance.

Interactive Dimension of Ambidexterity and New Product Development

Central to the interactive dimension is the mutual beneficial effects of exploitation and exploration (Cao et al., 2009). Gupta et al. (2006) point out that exploration and exploitation may take place in complementary domains. The research deriving from organization

research also reasons that through structural differentiation, top management integration, fostering appropriate context, or sequential shifting, exploitation and exploration can have positive interactions on innovation (Cao et al., 2009; Gibson and Birkinshaw, 2004; Jansen et al., 2009; Simsek et al., 2009; Tushman and O'Reilly, 1996).

The mechanism underling this positive interaction is the absorptive capacity logic. A high degree of exploitative effort can act as absorptive capacity and thus improve a firm's effectiveness in exploring new knowledge that supports new product development. According to absorptive capacity, a firm's knowledge base underpins how well it can identify, assimilate, and leverage new knowledge for new product development (Bierly, Damanpour, and Santoro, 2009; Cohen and Levinthal, 1990; Lane, Koka, and Pathak, 2006). The repeated use of existing knowledge and resources can deepen the understanding of their functionality (Cao et al., 2009). The deeper understanding enables firms to recognize and assimilate new external knowledge and thus facilitate knowledge exploration during the process of new product development (Cohen and Levinthal, 1990; Zahra and George, 2002). Furthermore, firms with a high level of exploitative learning may provide more complementary resources such as marketing capabilities, capabilities to link firms with customers, and sale channels for firms to transform new explored knowledge to new products. Therefore, it is hypothesized:

H2: The interactive dimension is positively related to new product development performance.

The Moderating Effects of Resource Flexibility

The relative exploratory dimension promotes new product development by escaping from exploitative traps to explore new knowledge for new product development. The higher the level of relative exploration to exploitation, the more resource is needed to utilize the new knowledge to develop new products. When resource flexibility is low, the resource specificity is high. In this case, the current resources are intensely bounded to specified targets, and it is difficult for firms to employ them for other courses of actions (Liu et al., 2009; Sanchez, 1995). Therefore, the explorative learning and exploitative learning may fuel competition for scarce resources (Cao et al., 2009; March, 1991, 1996, 2006). When resource flexibility is low, it is costly to find complementary resources for new knowledge during the new product development process (Gerwin, 1993; Koste, Malhotra, and Sharma, 2004). Thus, the resource accessibility constrains the effects of relative exploration on new product development. On the contrary, when firms have accumulated many flexible resources or resource flexibility is high, the existing flexible resources can be used more easily for new purposes. In this case, the time and cost spent on seeking new resources and switching from one use to another decreases (Liu et al., 2009; Matthysens, Pauwels, and Vandenbempt, 2005; Sanchez, 1995). Therefore, resource flexibility facilitates availability of new resources for exploration and sets less demand for totally new resources. Thus, resource flexibility should enhance the positive effects of the relative exploratory dimension on new product development performance. In this case, the extended resource pool may enable firms to conduct a higher level of relative explorative learning without resource competition. In particular, when the relative exploratory dimension is high, internal flexible resources may weaken the negative effects caused by the difficulty to integrate new knowledge. High resource flexibility reduces the risk and cost to find complementary resources for new knowledge or new technologies (Combs, Ketchen, Ireland, and Webb, 2011; Zhou and Wu, 2010).

The central logic to the positive interaction is a dynamic learning mechanism implied by absorptive capacity theory (Cao et al., 2009; Katila and Ahuja, 2002). The interactive dimension indicates the efforts to leverage their complementary effects by conducting a high level of exploration and exploitation (Cao et al., 2009). However, research on complementary assets (Teece, 1986) suggests that behind this complementary effect is the resource sharing, resource integration, and resource orchestration between exploitation and exploration

(Sirmon et al., 2011). When they share resources such as production facilities, managerial resources, and marketing channel, exploration may complement with exploitation to promote new product development (Christensen, 1997). Kraatz and Zajac (2001) provided strong evidence for the “resources as commitments” perspective. This view suggests that the resource portfolios are often bounded with current products and strategies and thus often become barriers for exploratory learning. When resource flexibility is low, the resource specification is high. In this case, the exploration, which is departing from the resource base for exploitation, may create difficulties sharing and employing the existing resource base. When resource flexibility increases, more resources are multifunctional and thus can be shared with exploration. Therefore, when resource flexibility increases, the complementary effects of exploration and exploitation may be strengthened to promote new product development. Therefore, it is hypothesized:

H3a: When the relative exploratory dimension is low, resource flexibility strengthens the positive effect of the relative exploratory dimension on new product development performance; when the relative exploratory dimension is high, resource flexibility weakens the negative effect of the relative exploratory dimension on new product development performance.

H3b: Resource flexibility strengthens the positive effect of the interactive dimension on new product development performance.

The Moderating Effects of Coordination Flexibility

In addition to accumulating more flexible resources, firms may extend their resource base through internal resource reconfiguration. Resource reconfiguration undermines the organization ambidexterity. When exploratory learning is relatively higher than exploitative learning, brand-new bundles of resources are required to utilize new knowledge for new product development (Combs et al., 2011). Firms should be able to integrate and reconfigure the resources across the units for new explorative learning. Coordination flexibility represents efforts to synthesize subdivided functions and reconfigure internal and external resource portfolio (Sanchez, 1995, 1997). In this case, the coordination flexibility relaxes routine inertia and helps firms to explore new bundles of resources (Gilbert, 2005; Zhou and Wu, 2010). Thus, coordination flexibility can help firms to efficiently integrate and recombine internal and external resources for the new market opportunities. The firms with high coordination

flexibility may help firms to quickly achieve the conjunction between the innovation and complementary asset and to further gain profit from the innovation (Li, Liu, and Duan, 2008; Li, Su, and Liu, 2010). In dynamic product markets, firms with a high level of coordination flexibility may adjust in product creation quickly by creating a new reconfiguration of resources and redeploying them effectively (Sanchez, 1995, 1997). Therefore, as one type of dynamic capability, coordination flexibility may help firms to break the structural inertia caused by resource dependency (Hannan and Freeman, 1984) and thus enhance the positive effect of the relative exploratory dimension on new product development. Furthermore, when the relative exploratory dimension is very high, coordination flexibility can enable firms to integrate new knowledge with the current resource portfolio and thus reduce the integrating cost and risk.

The coordination of exploratory and exploitative efforts across organizational units is a necessary step in achieving ambidexterity (Jansen et al., 2009; Smith and Tushman, 2005; Tushman and O'Reilly, 1996). The implementation or deployment of such combinations and the achievement of ambidexterity require new organizing logics and collective patterns of interaction (Helfat and Peteraf, 2003). Hence, to resolve these paradoxical situations, the mobilization, integration, and deployment of operational capabilities are crucial to achieve ambidexterity. The dynamic capabilities framework recognizes this important aspect. It argues that dynamic capabilities, which are embedded in the distinct ways that organizations flexibly integrate, build, and recombine competences across boundaries, are fundamental to long-term strategic advantage (Eisenhardt and Martin, 2000; Helfat et al., 2007; Henderson and Cockburn, 1994; Kogut and Zander, 1992; Teece et al., 1997). Jansen et al. (2009) reason that integration mechanisms are needed to leverage the complementary effect of exploitative and exploratory learning. Compared with resource flexibility, coordination flexibility is one type of dynamic capability that enables organizations to mobilize, coordinate, and integrate dispersed exploratory and exploitative efforts to achieve complementary effects (Zhou and Wu, 2010). When coordination flexibility is high, firms can recombine current resources to break resource dependency and remove the change resistance. Furthermore, coordination flexibility can also enhance the positive effect of exploration on exploitation. Zhou and Wu (2010) find that, coupled with coordination flexibility, firms tend to leverage the pool of accumulated technological capability to promote new product development. Therefore, it is hypothesized:

H4a: When the relative exploratory dimension is low, coordination flexibility strengthens the positive effect of the relative exploratory dimension on new product development performance; when the relative exploratory dimension is high, coordination flexibility weakens the negative effect of the relative exploratory dimension on new product development performance.

H4b: Coordination flexibility strengthens the positive effect of the interactive dimension on new product development performance.

Methodology

Sample and Data Collection

Data for this study were obtained through an interview survey. The sample covers the firms from a broad scope of industries and different districts of China, which may reduce system error caused by difference of economy and culture in different districts. The companies were randomly selected out of the list of registered corporations provided by the Economy Commerce Committee, which is a special administrative institute to manage the firms located in each province.

This questionnaire is originally designed in English based on several previous studies on ambidexterity, strategic flexibility, and new product development. A back-translation procedure was performed to ensure translation accuracy (Brislin, 1970). Next, a pilot test was conducted with 10 firms, and necessary modifications were made on the questionnaire based on the feedback from this pre-testing. To make sure the respondents were knowledgeable, the top managers or department leaders were contracted. The survey was undertaken on site at each firm. A total of 650 firms were approached and 232 firms participated. Due to missing data, our final sample includes 213 firms, which represented a response rate of 32.77%. To check nonresponse bias, a *t*-test was performed to compare the responding and nonresponding firms along firm attributes such as firm size, ownership status, sales, and age. All *t*-statistics were insignificant, which indicates a low possibility of nonresponse bias.

Measures

All items were answered on a 5-point Likert scale (Table 1), and the constructs were measured by the factor scores obtained by running the factor analysis with Mplus software (7.0; Muthen & Muthen, Los Angeles, CA, USA).

Organizational learning ambidexterity. Ambidexterity is an integrative construct of exploration and

Table 1. Standard Estimates and Coefficient Alpha

| Variables | Items | Loading | Alpha |
|---|---|---------|-------|
| New product development (Garcia et al., 2008; Griffin and Page, 1993; Molina-Castillo and Munuera-Aleman, 2009) | Compared with our major competitors, we are more successful in terms of: | | .842 |
| | New-product success rate is better | .831 | |
| | Time to market is shorter | .900 | |
| | Development cycle is shorter | .796 | |
| | Market potential of our new products | .764 | |
| Exploitative learning (Atuahene-Gima and Murray, 2007) | Our aim was to search for information to refine common methods and ideas in solving problems in the project. | .712 | .713 |
| | Our aim was to search for ideas and information that we can implement well to ensure productivity rather than those ideas that could lead to implementation mistakes in the project and in the marketplace. | .668 | |
| | We searched for the usual and generally proven methods and solutions to product development problems. | .529 | |
| | We used information acquisition methods (e.g., survey of current customers and competitors) that helped us understand and update the firm's current project and market experiences. | .744 | |
| | We emphasized the use of knowledge related to our existing project experience. | .759 | |
| Explorative learning (Atuahene-Gima and Murray, 2007) | In information search, we focused on acquiring knowledge of project strategies that involved experimentation and high market risks. | .664 | .701 |
| | We preferred to collect information with no identifiable strategic market needs to ensure experimentation in the project. | .716 | |
| | Our aim was to acquire knowledge to develop a project that led us into new areas of learning such as new markets and technological areas. | .657 | |
| | We collected novel information and ideas that went beyond our current market and technological experiences. | .656 | |
| | Our aim was to collect new information that forced us to learn new things in the product development project. | .684 | |
| Resource flexibility (Sanchez, 1995,1997; Zhou and Wu, 2010) | There is a large range of alternative uses to which our major resources can be applied. | .617 | .848 |
| | The difficulty of switching from one use of our major resources to an alternative use is low. | .819 | |
| | The time required to switch to an alternative resource use is short. | .910 | |
| | The costs of switching from one use of our major resources to an alternative use are low. | .888 | |
| | The major resources can be allocated to develop, manufacture, and deliver a diverse line of products. | .705 | |
| Coordination flexibility (Sanchez, 1995,1997; Zhou and Wu, 2010) | Internal units often collaborate with each other to find a new use for internal resources. | .841 | .850 |
| | The firm often finds new resources through communication between units. | .839 | |
| | The firm often finds new resources and/or new combinations of existing resources. | .851 | |
| | The firm often finds new resources and/or new combinations of external resources. | .794 | |

exploitation, and therefore the relative exploratory dimension and the interactive dimension of ambidexterity are measured based on the measures of explorative learning and exploitative learning (Cao et al., 2009). The exploration and exploitation scale was adopted from Atuahene-Gima and Murray's (2007) items (Table 1, Cronbach's alpha = .713; .701).

The relative exploratory dimension of ambidexterity.

The relative exploratory dimension refers to the relative magnitude of exploration and exploitation. He and Wong (2004) and Cao et al. (2009) measure the balance magnitude with an absolute difference subtracted by 5. However, this method neglects the direction of the difference with an often untenable assumption that the direction of imbalance does not matter (Kim and Hsieh, 2003). Furthermore, this essentially measures the extent to

which exploration is equal to exploitation. This study argues that the point where exploration matches with exploitation may not necessarily be the point where exploration is equal to exploitation. Following Uotila et al. (2009), Dayan and Di Benedetto (2010), and also Dayan and Di Benedetto (2011), we measure relative dimension by dividing exploratory learning by the sum of exploratory and exploitative learning. The formula is as follows:

Relative exploratory dimension

$$= \frac{\text{Exploratory Learning}}{\text{Exploratory Learning} + \text{Exploitative Learning}}$$

The interactive dimension of ambidexterity. Following previous treatments used by He and Wong (2004), Gibson and Birkinshaw (2004), and Cao et al. (2009),

exploration and exploitation were multiplied to measure the interactive dimension. The formula is given by:

$$\text{Interactive Dimension} \\ = \text{Exploratory Learning} * \text{Exploitative Learning}$$

New product development. Because archival sources of data on the new product development performance were unavailable, this study relied on key informants to provide subjective valuation (Chandler and Hanks, 1993). Informants rated the degree of a new product's success relative to success rates, time to market, development cycle, and market potential of new product development (Garcia, Sanzo, and Trespalacios, 2008; Griffin and Page, 1993; Molina-Castillo and Munuera-Aleman, 2009) (Table 1; Cronbach's alpha = .842).

Strategic flexibility. Based on the work of Sanchez (1995, 1997), the essence of resource flexibility can be characterized by the range of uses and the cost and/or time of switching from one use of a resource to an alternative one. This study measured resource flexibility with five items (Table 1; Cronbach's alpha = .848) and measured coordination flexibility with four items (Table 1; Cronbach's alpha = .851).

Control variables. A variety of organizational and environmental factors are controlled. Firm age and firm size likely affect new product development because the longer a firm exists and the larger it is, the more resources it has. Firm age is measured by calculating the natural logarithm of the number of years since a firm was founded, and firm size is measured by calculating the natural logarithm of total asset (Rothaermel and Deeds, 2004). The study also controlled industry type, which could determine the companies' technological opportunities and the frequency of radically new products (Ali, Kalwani, and Kovenock, 1993; Klevorick, Levin, Nelson, and Winter, 1995). Following the approach of Zahra and Nielsen (2002), this study controlled industry type by calculating an industry's index. First, the average scores of new product development (NPD) for each type of industry are calculated and then are subtracted from a firm's score. Second, the difference between a firm's NPD score and average score for the industry is then divided by each industry's average score (Zahra and Covin, 1993; Zahra and Nielsen, 2002). As life cycle has been shown to influence new product introduction (Filsom, 2002; Liu et al., 2009; MacMillan and Day, 1987), this study measured the stage of an industry's life cycle in terms of the stage of the most key product in its life cycle and 1 = Intro-

duction stage, 2 = Growth stage, 3 = Maturity stage, and 4 = Decline stage. The competition intensity, whose significant role has been proven (Auh and Menguc, 2005; Jansen et al., 2009), was also controlled. This study measured competition intensity on a 1–5 Likert scale item: In our market, the competition is severely intense. Demand information collection and internal sharing benefit new product development (Narver, Slater, and MacLachlan, 2004; Wei and Morgan, 2004). This study measured with two 1–5 Likert scale items: (1) We often collect information on customer demand and customers' preferences; (2) We freely communicate information about our successful and unsuccessful customer experiences across internal functions. The effects of exploitative learning, exploratory learning, resource flexibility, and also coordination flexibility on new product development were also controlled.

Reliability and Validity

First, this study conducted an exploratory factor analysis on the scale items by the principal component method rotated with Varimax, which extracted five components: explorative learning, exploitative leaning, resource flexibility, coordination flexibility, and new product development. Most of the factor loadings are above .7, indicating high convergent validity (Fornell and Larcker, 1981; Gefen, Straub, and Boudreau, 2000). Furthermore, the reliability analyses show that the Cronbach's alpha values, ranging from .701 to .850, are all greater than the .7 cutoff, which indicates adequate reliability.

Second, this study checked the discriminant validity using the confirmatory factor analysis (CFA) method and also the average variance extracted (AVE) method. First, this study compared a restricted model (correlation fixed to 1) with a freely estimated model (correlated estimated freely) for each pair of constructs. The chi-square difference test showed that in each case a two-factor model had a better fit than a single-factor model, which indicates good discriminant validity (Anderson and Gerbing, 1988). Second, this study calculated the square roots of the AVE and compared them with correlations. As Table 2 shows, the diagonal elements representing the square roots of the AVE for each construct are significantly greater than the off-diagonal elements. This satisfies Fornell and Larcker's (1981) criterion for discriminant validity.

Assessing Common Method Bias

This study undertook several procedures recommended by Podsakoff, Mackenzie, Lee, and Podsakoff (2003) to examine the severity of common method bias. First, we

Table 2. Descriptive Statistics and Correlation Matrix ($n = 213$)

| | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|------------------------------------|-------|------|--------|-------|--------|-------|--------|--------|--------|--------|-------|---------|----------|--------|--------|-------|
| 1. Firm age | 2.39 | .94 | N/A | | | | | | | | | | | | | |
| 2. Firm size | 11.34 | 4.20 | .33*** | N/A | | | | | | | | | | | | |
| 3. Industry | N/A | N/A | -.08 | .14* | N/A | | | | | | | | | | | |
| 4. Stage of industry life cycle | 2.58 | .68 | .28*** | .14* | -.11 | N/A | | | | | | | | | | |
| 5. Competition intensity | 4.20 | .99 | -.01 | -.03 | .09 | -.06 | N/A | | | | | | | | | |
| 6. Demand information collection | 4.07 | .98 | -.10 | .00 | .21** | -.17* | .33*** | N/A | | | | | | | | |
| 7. Demand information sharing | 3.65 | 1.08 | -.19** | -.11 | .16* | -.10 | .21** | .51*** | N/A | | | | | | | |
| 8. Resource flexibility | 2.73 | .82 | -.08 | -.06 | .00 | -.04 | -.06 | .05 | .07 | (.79) | | | | | | |
| 9. Coordination flexibility | 3.18 | .80 | -.14* | -.05 | .40*** | -.07 | .19** | .31*** | .50*** | -.01 | (.83) | | | | | |
| 10. Exploratory learning | 2.75 | .62 | .02 | .07 | .01 | -.06 | -.10 | -.03 | .05 | .37*** | -.07 | (.67) | | | | |
| 11. Exploitative learning | 2.99 | .56 | .10 | .08 | -.05 | .03 | -.01 | -.10 | .02 | .29*** | -.04 | .54*** | (.69) | | | |
| 12. Relative exploratory dimension | .48 | .06 | -.061 | .029 | .047 | -.077 | -.090 | .049 | .011 | .125 + | -.055 | .622*** | -.302*** | N/A | | |
| 13. Interactive dimension | .19 | .37 | -.127+ | -.101 | -.067 | -.090 | -.003 | -.020 | .082 | .191** | .040 | .093 | .159* | -.122+ | N/A | |
| 14. New product development | 3.58 | 1.02 | .08 | .10 | .02 | -.02 | -.03 | .08 | .04 | .39*** | .18** | .33*** | .23*** | .171* | .117 + | (.82) |

*, **, and *** indicate that correlation is significant at the .05, .01, .001 level (two tailed).
N/A, this item is not adaptive to analysis.

conducted Harman's one-factor test on all items. Five factors were drawn out, and the largest factor explains 28.9%, which indicates little threat of common method variance. Second, this study further used a CFA approach to test common method variance (Menon, Bharadwaj, and Howell, 1996; Sabherwal and Becerra-Fernandez, 2005). A model positing that a single factor underlies all the variables was assessed by linking all items of the dependent and independent factors to a single factor. This model does not fit the data well and is not acceptable (chi-square/degrees of freedom [df] = 6.023, root mean square error of approximation [RMSEA] = .154, comparative fit index [CFI] = .77, non-normed fit index [NNFI] = .74, incremental fit index [IFI] = .77, and goodness-of-fit index [GFI] = .63). When all items were assigned to their theoretical factors, the model fits the data well (chi-square/df = 2.143, RMSEA = .073, CFI = .94, NNFI = .93, IFI = .94, and GFI = .83). Therefore, the CFA test shows that no serious threat of common method bias exists (Sabherwal and Becerra-Fernandez, 2005). Third, this study also examined the correlation between subjective and objective measurements of new product development performance. Common method variance is often caused by a subjective measurement of dependent variables (Podsakoff and Organ, 1986). This study obtained the number of new product data from a subsample of 26 of the 213 firms. Our subjective and objective new product development performance measures are significantly correlated ($r = .529, p < .01$), which also supports the results of the above tests for common method variance. Fourth, this study tested common method bias with the latent variable approach suggested by Podsakoff et al. (2003) and examined the significance of the structural parameters both with and without the latent common method variance factor in the model. All significant relationships held after controlling for the latent common method variance factor, which indicates that common method variance is not an issue in this study (Li, Bingham, and Umphress, 2007; Zhang and Li, 2010). Overall, these results suggested little threat of common method bias.

Analysis and Results

Table 2 reports the descriptive statistics and correlations of the variables. No interfactor correlations are above the .65 threshold, suggesting that our estimations are not likely to be biased by multicollinearity problems (Tabachnick and Fidell, 1996).

Multivariate regression analysis and the moderated method (Baron and Kenny, 1986) were employed to test the hypotheses. Table 3 presents the steps performed to

Table 3. The Results of Regression Analyses ($n = 213$)

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|----------|----------|----------|----------|----------|
| 1. Firm age | .049 | .051 | .076 | .072 | .060 |
| 2. Firm size | .136* | .133* | .134* | .125* | .102+ |
| 3. Industry type | -.085 | -.017 | -.035 | -.028 | .103 |
| 4. Stage of industry life cycle | -.042 | -.038 | -.054 | -.051 | -.026 |
| 5. Competition intensity | -.098 | -.075 | -.035 | -.042 | -.041 |
| 6. Demand information collection | .148* | .171** | .205*** | .196*** | .208*** |
| 7. Demand information sharing | -.128+ | -0.144+ | -.121+ | -.136+ | -.147* |
| 8. Exploratory learning (Exr) | .137* | .165* | .120 + | .117 + | .109 |
| 9. Exploitative learning (Exi) | .087 | .090 | .010 | .024 | .022 |
| 10. Resource flexibility | .402*** | .404*** | .327*** | .349*** | .211** |
| 11. Coordination flexibility | .229*** | .222*** | .182*** | .193*** | .057 |
| 12. Relative exploratory dimension | | .079 | | .085 | .184* |
| 13. Squared relative exploratory dimension | | -0.145* | | -.124+ | -.524*** |
| 14. Interactive dimension (Exr * Exi) | | | .259*** | .231*** | .090 |
| 15. Resource flexibility * Relative exploratory dimension | | | | | .090 |
| 16. Resource flexibility * Squared relative exploratory dimension | | | | | .210* |
| 17. Coordination flexibility * Relative exploratory dimension | | | | | .063 |
| 18. Coordination flexibility * Squared relative exploratory dimension | | | | | .348** |
| 19. Resource flexibility * Interactive dimension | | | | | .304*** |
| 20. Coordination flexibility * Interactive dimension | | | | | .343*** |
| R^2 | .313 | .339 | .337 | .347 | .451 |
| Adjusted R^2 | .218 | .240 | .249 | .252 | .333 |
| F -value | 3.306*** | 3.723*** | 3.861*** | 3.671*** | 3.828*** |

+, *, **, and *** indicate that correlation is significant at the .1, .05, .01, .001 level (two tailed).

test the hypotheses. Before the analysis, all the variables included in interaction terms were mean-centered to minimize the threat of multicollinearity (Aiken and West, 1991). Furthermore, the variance inflation factors in all models are below 3, which are well below the cutoff of 10 (Neter, Wasserman, and Kutner, 1990).

Model 1 just included the control variables that explained a significant share of the variance in new product development (model 1: $R^2 = .313$, $p < .001$). In model 2, this study added the relative exploratory dimension and the square of the relative exploratory dimension. The results show that the coefficient of the relative exploratory dimension is insignificant, whereas the square of the relative exploratory dimension is significantly negative. This finding indicates that the relative exploratory dimension has an inverse U-shaped effect on new product development performance. Thus, H1 is supported. In model 3, this study added the interactive dimension and found that the interactive dimension has a significantly positive effect on new product development. Therefore, H2 is also supported. In model 4, this study added the relative exploratory dimension, the square of the relative exploratory dimension, and also the interactive dimension; the findings also confirm the prediction of H1 and H2.

To test the moderate effect of resource flexibility and coordination flexibility, all the relevant interactions were

entered to run model 5. Model 5 shows that the interaction of resource flexibility and the square of the relative exploratory dimension is significantly positive (model 5: $\beta = .210^*$, $p < .05$) and that of resource flexibility and the interactive dimension is significantly positive (model 5: $\beta = .304^{***}$, $p < .001$). Model 5 also shows that the interaction of coordination flexibility and the square of the relative exploratory dimension is significantly positive (model 5: $\beta = .348^{**}$, $p < .05$) and that of coordination flexibility and the interactive dimension is significantly positive (model 5: $\beta = .343^{***}$, $p < .001$).

Following Schoonhoven's (1981) recommendation, to gain further insight into these interaction effects and evaluate the moderating effects of resource flexibility and coordination flexibility, this study plots the relationships employing the steps of Aiken and West (1991) in Figure 2a and b and Figure 3a and b. As Figure 2a and b shows, at the low level of the relative exploratory dimension, the effect of the relative exploratory dimension on new product development increases more rapidly when the level of resource flexibility or coordination flexibility shifts from low to high (the slope increases), whereas the negative effect decreases when the relative exploratory dimension passes the reflection point if the level of resource flexibility or coordination flexibility shifts from low to high (the slope decreases). This indicates

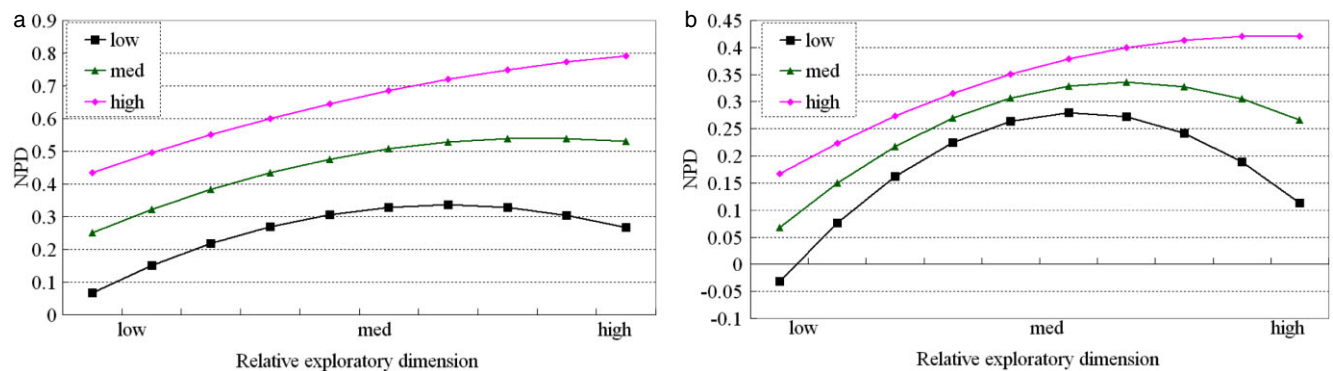


Figure 2. a) The Moderating Effect of Resource Flexibility on the Effect of the Relative Exploratory Dimension on NPD. b) The Moderating Effect of Coordination Flexibility on the Effect of the Relative Exploratory Dimension on NPD

that resource flexibility and coordination flexibility strengthen the positive effect of the relative exploratory dimension when the relative exploratory dimension is low and weakens the negative effects caused by a too high relative exploratory dimension. Therefore, H3a and H4a are both supported. As Figure 3a and b show, the effect of the interactive dimension increases more rapidly when the level of resource flexibility or coordination flexibility shifts from low to high (the slope increases). This indicates that the resource flexibility or coordination flexibility strengthens the effects of the interactive dimension. Therefore, H3b and H4b are both strongly supported.

Discussion

This research seeks to extend our understanding on how firms dynamically reconfigure a resource portfolio to leverage organization learning ambidexterity for new product development. By extending the static resource assumption that is central to the extant debate in organizational ambidexterity literature, this research unpacks

ambidexterity into the relative exploratory dimension and the interactive dimension and further investigates the moderating effect of resource flexibility and coordination flexibility on the effects of the two dimensions on new product development performance. This research contributes to the ambidexterity literature by extending our understanding of how to dynamically leverage scarce resources to structure exploitation and exploration for new product development.

First, this study finds that the relative exploratory dimension and the interactive dimension have different effects on new product development. The results indicate that the relative exploratory dimension has an inverse U-shaped effect on new product development, whereas the interactive dimension has a positive effect. Our results indicate that the moderate level of relative explorative learning to exploitative learning benefits new product development. Furthermore, exploratory learning and exploitative learning have synergic effects on new product development. This finding indicates that the effort to appropriately balance and the effort to create

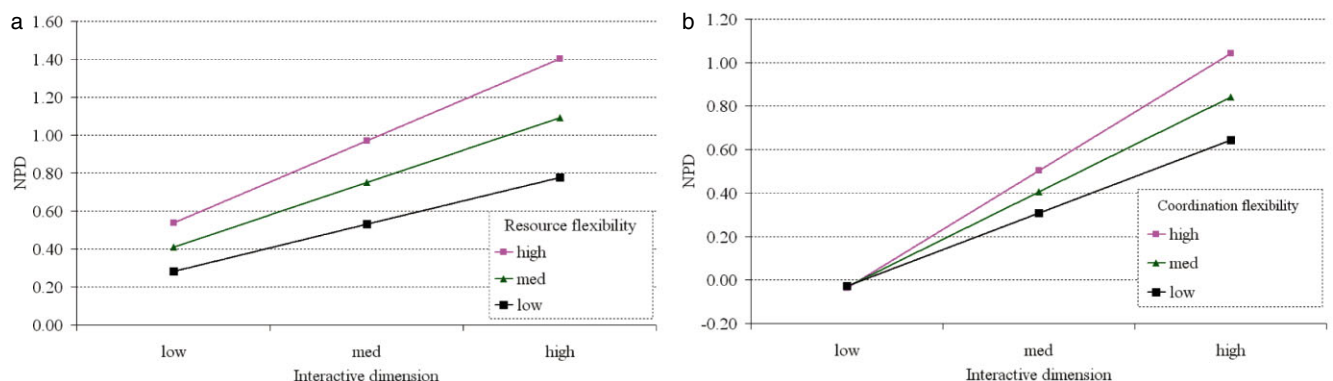


Figure 3. a) The Moderating Effect of Resource Flexibility on the Effect of the Interactive Dimension on NPD. b) The Moderating Effect of Coordination Flexibility on the Effect of the Interactive Dimension on NPD

synergic effects of explorative learning and exploitative learning are both crucial for new product development (Cao et al., 2009). This suggests that explorative learning and exploitative learning form a paradox. They are simultaneously complete and interrelated (Smith and Lewis, 2011). This finding supports the prediction of the paradox view, which suggests that exploratory learning and exploitative learning are both compatible and complementary (Smith and Lewis, 2011). These findings also shed light to resolve ongoing debate. According to our findings, the incompatible view and the complementary view just describe the complete or complementary aspect of the whole picture of organization ambidexterity. Our findings suggest that new product development relies on a holistic problem-solving approach that embraces both exploration and exploitation (Chen, 2002; Smith and Lewis, 2011). Firms should appropriately and dynamically balance the relative level of exploration to exploitation to find the optimal structure and simultaneously firms should align exploitation and exploration to achieve their complementary effects (Chen, 2002; Smith and Lewis, 2011). This research also extends extant literature by bringing new insights from paradox views and more clarified conceptual dimensions of organizational ambidexterity.

Second, this study finds that resource flexibility and coordination flexibility have positive moderating effects on the relationships between relative exploratory dimensions and the interactive dimension and new product development performance. This finding supports the prediction of dynamic resource management views and suggests that when firms accumulate dysfunctional resources or excel in internally reconfiguring resources to create new resource bundles, the role of organizational ambidexterity may be more leveraged for new product development (Sirmon et al., 2007, 2008, 2011). Firms with a higher level of resource flexibility or coordination flexibility can conduct a higher level of relative exploratory learning to exploitative learning.

This research extends the resource scarcity assumption by moving our research focus from a static resource endowment view to a dynamic management view. The resource perspective has been central to the debate in the organization ambidexterity literature. The incompatible view focuses on static resource endowment and the key assumption behind the internal resource scarcity. However, this assumption is not always true when considering the dynamic resources management view. The dynamic resources management view suggests that resource portfolios can be extended by accumulating multifunctional resources and reconfiguring resource

bundles (Sanchez, 1995; Sirmon et al., 2007, 2011). Furthermore, the complementary view is mainly silent on these resource management issues, whereas resource aligning capabilities are crucial to achieve complementary effects of exploration and exploitation (Jansen et al., 2009; Sirmon et al., 2007). This research finds that, as dynamic resource management capabilities, resource flexibility and coordination flexibility can enable firms to create a higher level of synergic effects of exploratory learning and exploitative learning.

This finding also extends our understanding on the notion of balance. Although some literature argues that the balance means the equal level of exploitation and exploration (Cao et al., 2009; He and Wong, 2004), other literature contends that the balance means high (low) exploitation needs to be coupled with low (high) exploration (Atuahene-Gima and Murray, 2007; Benner and Tushman, 2003; Nerkar, 2003). However, our findings suggest that the optimal relative level of exploration to exploitation is contingent on the level of resource flexibility or coordination flexibility. The points where exploitation and exploration are equal just represent one special case of relative exploratory dimension. When the level of resource flexibility or coordination flexibility is higher, the level at which the reflection point of the inverse U-shaped effects emerges increases. Therefore, firms with a lower level of resource flexibility or coordination flexibility should reduce the relative level of exploratory learning to exploitative learning, whereas firms with a higher level of resource flexibility or coordination flexibility should increase the relative level of exploratory learning to exploitative learning.

Managerial Implications

Our findings also provide important managerial implications. First, regarding the significant effects of both the relative exploratory dimension and the interactive dimension of organizational learning ambidexterity, firms should rely on two different efforts to promote new product development. On one hand, firms should appropriately balance exploratory and exploitative learning. Firms should avoid too much higher level of relative exploratory learning to exploitative learning, because the positive effect of the relative exploratory dimension on new product development declines when the relative exploratory dimension is too high. On the other hand, firms should realize that exploitative and exploratory learning can be arranged properly to achieve complementarities because they can form a dynamic learning cycle. More importantly, firms should simultaneously

make the above two efforts to leverage the benefits of organization ambidexterity. Furthermore, firms should balance the relative level of exploratory learning to exploitative learning according to the level of resource flexibility or coordination flexibility rather than just try to keep exploratory learning equal to exploitative learning. Firms with a higher level of resource flexibility or coordination flexibility can conduct a higher level of the relative exploratory learning to improve new product development. Second, firms should build resource flexibility and coordination flexibility to enhance their opportunities to achieve the benefits of the two dimensions. According to our findings, firms should develop dysfunctional flexible resources or develop resource reconfiguring capabilities to create new resource options to reduce the resource competition between explorative learning and exploitative learning and to create their synergistic effects.

Limitations and Future Research

Despite its contributions, this study also has limitations that should be addressed in future research. First, our sample is from China, which is a transitional economy. The Chinese firms may be somewhat resource deficient relative to similar firms located in developed countries. Thus, although our sample of Chinese firms provides an excellent basis for the identification and examination of the effect of organizational ambidexterity and also the moderating effect of strategic flexibility, future research should be conducted with samples from developed countries to test the generalizability of our findings. Second, although recent advances in the resource-based view suggest that firms can structure, bundle, and leverage resources by interfirm dynamic processes, this research mainly focuses on internal resource management capabilities. Further research should be done to investigate resource management processes across firms, such as external resource acquisition, resource divesting, and also interfirm collaboration. Third, although structural equation modeling is an accurate method to capture the whole domain of multi-item scale interaction, this study employs regression analysis to test our hypotheses because of the limitation of the sample size.

Conclusion

Previous literature on organizational learning ambidexterity mainly focuses on static resource endowment and offers little insight about how firms should dynamically reconfigure resource portfolios to leverage organizational ambidexterity for new product development. Further-

more, the conceptual confusion on the notion of the balance dimension of ambidexterity still exists. By extending the static resource assumption that is central to the extant debate in organizational ambidexterity literature, this research unpacks ambidexterity into a relative exploratory dimension and an interactive dimension, and further investigates the moderating effect of resource flexibility and coordination flexibility on the effects of the two dimensions on new product development performance. Based on organizational learning theory, the paradox perspective, and the dynamic resource management view, this study finds that the relative exploratory dimension has an inverse U-shaped effect on new product development, whereas the interactive dimension has a positive effect. Furthermore, this study finds that resource flexibility and coordination flexibility have positive moderating effects on the relationships between the relative exploratory dimension and the interactive dimension and new product development performance.

Our research extends ambidexterity research from a static view to a dynamic view by exploring the moderating effects of resource flexibility and coordination flexibility. This study also brings greater conceptual clarity to the notion of the balance dimension of ambidexterity and provides new evidence on the effects of ambidextrous learning on new product development performance in transition economies such as China. According to our findings, firms can promote new product development by appropriately balancing the relative level of exploratory learning to exploitative learning and creating their interactive complementarities. Furthermore, firms should balance the relative level of exploratory and exploitative learning according to the level of resource flexibility or coordination flexibility rather than just try to keep them equal. Firms should build resource flexibility and coordination flexibility to enhance the effects of the two dimensions on new product development performance.

References

- Aiken, L. S., and S. G. West. 1991. *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage.
- Ali, A., M. U. Kalwani, and D. Kovenock. 1993. Selecting product development projects: Pioneering versus incremental innovation strategies. *Management Science* 39 (3): 255–74.
- Alvarez, S. A., and J. B. Barney. 2007. Discovery and creation: Alternative theories of entrepreneurial action. *Strategic Entrepreneurship Journal* 1 (1): 11–26.
- Anderson, J. C., and D. W. Gerbing. 1998. Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin* 103 (3): 411–23.
- Andriopoulos, C., and M. W. Lewis. 2008. Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation. *Organization Science* 20 (4): 696–717.

- Atuahene-Gima, K., and J. Y. Murray. 2007. Exploratory and exploitative learning in new product development: A social capital perspective on new technology ventures in China. *Journal of International Marketing* 15 (2): 1–29.
- Auh, S., and B. Menguc. 2005. Balancing exploration and exploitation: The moderating role of competitive intensity. *Journal of Business Research* 58 (12): 1652–61.
- Baron, R., and D. Kenny. 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* 51 (6): 1173–82.
- Benner, M. J., and M. L. Tushman. 2003. Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review* 28 (2): 238–56.
- Bierly, III, P. E., F. Damanpour, and M. D. Santoro. 2009. The application of external knowledge: Organizational conditions for exploration and exploitation. *Journal of Management Studies* 46 (3): 481–509.
- Birkinshaw, J., and C. Gibson. 2004. Building ambidexterity into an organization. *MIT Sloan Management Review* 45 (4): 47–55.
- Brislin, R. 1970. Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology* 1 (3): 185–216.
- Burgelman, R. A. 2002. Strategy as vector and the inertia of coevolutionary lock-in. *Administrative Science Quarterly* 47 (2): 325–57.
- Cao, Q., E. Gedajlovic, and H. Zhang. 2009. Unpacking organizational ambidexterity: Dimensions, contingencies, and synergistic effects. *Organization Science* 20 (4): 1–16.
- Chandler, G. N., and S. H. Hanks. 1993. Measuring the performance of emerging businesses: A validation study. *Journal of Business Venturing* 8 (5): 391–408.
- Chen, M. J. 2002. Transcending paradox: The “middle way” perspective. *Asia Pacific Journal of Management* 19 (2): 179–99.
- Christensen, C. M. 1997. *The innovator's dilemma*. Boston: Harvard Business School Press.
- Cohen, W., and D. Levinthal. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly* 35 (1): 128–52.
- Combs, J. G., J. D. J. Ketchen, R. D. Ireland, and J. W. Webb. 2011. The role of resource flexibility in leveraging strategic resources. *Journal of Management Studies* 48 (5): 1098–125.
- Dayan, M., and C. A. Di Benedetto. 2010. The impact of structural and contextual factors on trust formation in product development teams. *Industrial Marketing Management* 39 (4): 691–703.
- Dayan, M., and C. A. Di Benedetto. 2011. Team intuition as a continuum construct and new product creativity: The role of environmental turbulence, team experience, and stress. *Research Policy* 40 (2): 276–86.
- Eisenhardt, K., and J. Martin. 2000. Dynamic capabilities: What are they? *Strategic Management Journal* 21 (10/11): 1105–21.
- Filsom, D. 2002. Product and process innovations in the life cycle of an industry. *Journal of Economic Behavior and Organization* 49 (1): 97–113.
- Floyd, S. W., and P. Lane. 2000. Strategizing throughout the organization: Management role conflict and strategic renewal. *Academy of Management Review* 25 (1): 154–77.
- Fornell, C., and D. F. Larcker. 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* 18 (1): 39–50.
- García, N., M. J. Sanzo, and J. A. Trespalacios. 2008. New product internal performance and market performance: Evidence from Spanish firms regarding the role of trust, inter-functional integration, and innovation type. *Technovation* 28 (11): 713–25.
- Gefen, D., D. W. Straub, and M. C. Boudreau. 2000. Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information Systems* 4 (7): 1–70.
- Gerwin, D. 1993. Manufacturing flexibility: A strategic perspective. *Management Science* 39 (4): 395–410.
- Gibson, C. B., and J. Birkinshaw. 2004. The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal* 47 (2): 209–26.
- Gilbert, C. G. 2005. Unbundling the structure of inertia: Resource versus routine rigidity. *Academy of Management Journal* 48 (5): 741–63.
- Griffin, A., and A. L. Page. 1993. An interim report on measuring product development success and failure. *Journal of Product Innovation Management* 10 (4): 291–308.
- Gupta, A. K., K. G. Smith, and C. E. Shalley. 2006. The interplay between exploration and exploitation. *Academy of Management Journal* 49 (4): 693–706.
- Hannan, M. T., and J. Freeman. 1984. Structural inertia and organizational change. *American Sociological Review* 49 (2): 149–64.
- He, Z.-L., and P.-K. Wong. 2004. Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science* 15 (4): 481–94.
- Helfat, C., S. Finkelstein, W. Mitchell, M. A. Peteraf, H. Singh, D. J. Teece, and S. G. Winter. 2007. *Dynamic capabilities: Understanding strategic change in organizations*. Oxford, UK: Blackwell.
- Helfat, C., and M. A. Peteraf. 2003. The dynamic resource-based view: Capability lifecycles. *Strategic Management Journal* 24 (10): 997–1010.
- Henderson, R., and I. Cockburn. 1994. Measuring competence? Exploring firm effects in pharmaceutical research. *Strategic Management Journal* 15 (S1): 63–84.
- Hoskisson, R. E., L. Eden, C. Lau, and M. Wright. 2000. Strategy in emerging economies. *Academy of Management Journal* 43 (3): 249–67.
- Jansen, J. J. P., M. P. Tempelaar, and F. A. J. Van den Bosch. 2009. Structural differentiation and ambidexterity: The mediating role of integration mechanisms. *Organization Science* 20 (4): 797–811.
- Jansen, J. J. P., F. A. J. Van den Bosch, and H. W. Volberda. 2006. Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Science* 52 (11): 1661–74.
- Katila, R., and G. Ahuja. 2002. Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal* 45 (6): 1183–94.
- Kim, N., and K. Atuahene-Gima. 2010. Using exploratory and exploitative market learning for new product development. *Journal of Product Innovation Management* 27 (4): 519–36.
- Kim, S. K., and P.-H. Hsieh. 2003. Interdependence and its consequences in distributor-supplier relationships: A distributor perspective through response surface approach. *Journal of Marketing Research* 40 (1): 101–12.
- Klevorick, A. K., R. C. Levin, R. R. Nelson, and S. G. Winter. 1995. On the sources and significance of inter-industry differences in technological opportunities. *Research Policy* 24 (2): 185–205.
- Kogut, B., and U. Zander. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Origination Science* 3 (3): 383–97.
- Koste, L. L., M. K. Malhotra, and S. Sharma. 2004. Measuring dimensions of manufacturing flexibility. *Journal of Operations Management* 22 (2): 171–96.
- Kraatz, S. M., and J. E. Zajac. 2001. How organizational resources affect strategic change and performance in turbulent environments. *Organization Science* 12 (5): 632–57.
- Lane, P. J., B. R. Koka, and S. Pathak. 2006. The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review* 31 (4): 833–63.
- Laursen, K., and A. Salter. 2006. Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal* 27 (2): 131–50.

- Levinthal, D., and J. G. March. 1993. The myopia of learning. *Strategic Management Journal* 14 (S1): 95–112.
- Li, H., J. B. Bingham, and E. E. Umphress. 2007. Fairness from the top: Perceived procedural justice and collaborative problem solving in new product development. *Organization Science* 18 (2): 200–16.
- Li, Y., Y. Liu, and Y. Duan. 2008. Entrepreneurial orientation, strategic flexibilities and indigenous firm innovation in transitional China. *International Journal of Technology Management* 41 (1/2): 223–46.
- Li, Y., Z. Su, and Y. Liu. 2010. Can strategic flexibility help firms profit from product innovation? *Technovation* 30 (5–6): 300–9.
- Li, Y., Z. L. Wei, and Y. Liu. 2010. Strategic orientations, knowledge acquisition, and firm performance: The perspective of the vendor in cross-border outsourcing. *Journal of Management Studies* 47 (8): 1457–82.
- Liu, Y., Y. Li, and Z. Wei. 2009. How organizational flexibility affects new product development in an uncertain environment: Evidence from China. *International Journal of Production Economics* 120 (1): 18–29.
- MacMillan, I. C., and D. L. Day. 1987. Corporate ventures into industrial markets: Dynamics of aggressive entry. *Journal of Business Venturing* 2 (1): 29–37.
- March, J. G. 1991. Exploration and exploitation in organizational learning. *Organization Science* 2 (1): 71–87.
- March, J. G. 1996. Continuity and change in theories of organizational action. *Administrative Science Quarterly* 41 (2): 278–87.
- March, J. G. 2006. Rationality, foolishness, and adaptive intelligence. *Strategic Management Journal* 27 (3): 201–14.
- Matthyssens, P., P. Pauwels, and K. Vandenbempt. 2005. Strategic flexibility, rigidity and barriers to the development of absorptive capacity in business markets: Themes and research perspectives. *Industrial Marketing Management* 34 (6): 547–54.
- Menon, A., S. G. Bharadwaj, and R. Howell. 1996. The quality and effectiveness of marketing strategy: Effects of functional and dysfunctional conflict in intra-organizational relationships. *Journal of the Academy of Marketing Science* 24 (4): 299–314.
- Molina-Castillo, F.-J., and J.-L. Munuera-Aleman. 2009. New product performance indicators: Time horizon and importance attributed by managers. *Technovation* 29 (10): 714–24.
- Narver, J. C., S. F. Slater, and D. L. MacLachlan. 2004. Responsive and proactive market orientation and new-product success. *Journal of Product Innovation Management* 21 (5): 334–47.
- Nerkar, A. 2003. Old is gold? The value of temporal exploration in the creation of new knowledge. *Management Science* 49 (2): 211–30.
- Neter, J., W. Wasserman, and M. H. Kutner. 1990. *Applied linear statistical models*. Homewood, IL: Irwin.
- Podsakoff, P. M., S. B. Mackenzie, J. Lee, and N. P. Podsakoff. 2003. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology* 88 (5): 879–903.
- Podsakoff, P. M., and D. W. Organ. 1986. Self-reports in organizational research: Problems and prospects. *Journal of Management* 12 (4): 531–44.
- Rothaermel, F. T., and D. L. Deeds. 2004. Exploration and exploitation alliances in biotechnology: A system of new product development. *Strategic Management Journal* 25 (3): 201–21.
- Sabherwal, R., and I. Becerra-Fernandez. 2005. Integrating specific knowledge: Insights from the Kennedy Space Center. *IEEE Transactions on Engineering Management* 52 (3): 301–15.
- Sanchez, R. 1995. Strategic flexibility in product competition. *Strategic Management Journal* 16 (S1): 135–59.
- Sanchez, R. 1997. Preparing for an uncertain future. *International Studies of Management and Organization* 27 (2): 71–95.
- Schoonhoven, C. B. 1981. Problems with contingency theory: Testing assumptions hidden within the language of contingency “theory.” *Administrative Science Quarterly* 26 (3): 349–77.
- Sheng, S., K. Z. Zhou, and J. J. Li. 2011. The effects of business and political ties on firm performance: Evidence from China. *Journal of Marketing* 75 (1): 1–15.
- Sidhu, J. S., H. R. Commandeur, and H. W. Volberda. 2007. The multifaceted nature of exploration and exploitation: Value of supply, demand, and spatial search for innovation. *Organization Science* 18 (1): 20–38.
- Simsek, Z., C. Heavey, and J. A. Veiga. 2009. Typology for aligning organizational ambidexterity’s conceptualizations, antecedents, and outcomes. *Journal of Management Studies* 46 (5): 864–94.
- Sirmon, D. G., S. Cove, and M. A. Hitt. 2008. Resource management in dyadic competitive rivalry: The effects of resource bundling and deployment. *Academy of Management Journal* 51 (5): 919–35.
- Sirmon, D. G., M. A. Hitt, and R. D. Ireland. 2007. Managing firm resources in dynamic environments to create value: Looking inside the black box. *Academy of Management Review* 32 (1): 273–93.
- Sirmon, D. G., M. A. Hitt, R. D. Ireland, and B. A. Gilbert. 2011. Resource orchestration to create competitive advantage: Breadth, depth and life cycle effects. *Journal of Management* 37 (5): 1390–412.
- Smith, W. K., and M. W. Lewis. 2011. Toward a theory of paradox: A dynamic equilibrium model of organizing. *Academy of Management Review* 36 (2): 381–403.
- Smith, W. K., and M. L. Tushman. 2005. Managing strategic contradictions: A top management model for managing innovation streams. *Organization Science* 16 (5): 522–36.
- Tabachnick, B. G., and L. S. Fidell. 1996. *Using multivariate statistics*. New York: Harper Collins College Publishers.
- Teece, D. J. 1986. Profiting from technological innovation: Implications for integration, collaboration, licensing, and public policy. *Research Policy* 15 (6): 285–305.
- Teece, D. J., G. Pisano, and A. Shuen. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal* 18 (7): 509–33.
- Tushman, M. L., and C. A. O’Reilly. 1996. Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review* 38 (4): 8–30.
- Uotila, J., M. Maula, and T. Keil. 2009. Exploration, exploitation, and financial performance: Analysis of S&P 500 corporations. *Strategic Management Journal* 30 (2): 221–31.
- Wang, H., and J. Li. 2008. Untangling the effects of overexploration and overexploitation on organizational performance: The moderating role of environmental dynamism. *Journal of Management* 34 (5): 25–951.
- Wei, Y., and N. A. Morgan. 2004. The supportiveness of organizational climate, market orientation, and new product performance in Chinese firms. *Journal of Product Innovation Management* 21 (6): 375–88.
- Wright, M., F. Igor, R. E. Hoskisson, and M. W. Peng. 2005. Strategy research in emerging economies: Challenging the conventional wisdom. *Journal of Management Studies* 42 (1): 1–33.
- Yalcinkaya, G., R. J. Calantone, and D. A. Griffith. 2007. An examination of exploration and exploitation capabilities: Implications for product innovation and market performance. *Journal of International Marketing* 15 (4): 63–93.
- Zahra, S. A., and J. G. Covin. 1993. Business strategy, technology policy and firm performance. *Strategic Management Journal* 14 (6): 451–78.
- Zahra, S. A., and G. George. 2002. Absorptive capacity: A review, reconceptualization and extension. *Academy of Management Review* 27 (2): 185–203.
- Zahra, S. A., and A. P. Nielsen. 2002. Sources of capabilities, integration and technology commercialization. *Strategic Management Journal* 23 (5): 377–98.
- Zhang, Y., and H. Y. Li. 2010. Innovation search of new ventures in a technology cluster: The role of ties with service intermediaries. *Strategic Management Journal* 31 (1): 88–109.
- Zhou, C. Z., and F. Wu. 2010. Technological capability, strategic flexibility, and product innovation. *Strategic Management Journal* 31 (5): 547–61.