Organizational learning, NPD and environmental uncertainty:

An ambidexterity perspective

ABSTRACT

On the theoretical level, this study formulates a research model that explains the relationship among the explorative learning, exploitative learning, new product development, environmental uncertainty and firm performance; and on the empirical level, it examines these relationships in the emerging economies context. The results suggest that both explorative learning and exploitative learning have inverted U-shaped relationship with firm performance, and that these two types of learning can work as complement. Next, NPD works as mediator between explorative learning and firm performance. Furthermore, the respective relationships between learning and firm performance are moderated by environmental uncertainty.

KEY WORDS: Explorative learning, exploitative learning, ambidexterity, new product development, environmental uncertainty, emerging markets

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INTRODUCTION

Organizational learning, which defined as the capability for organizations to create, disseminate, and exploit upon generated knowledge, is a necessary resource and capability for firms seeking to sustain a competitive advantage in today's marketplace (Barney, 1991; Grant, 1996). Two distinct concepts of learning can be identified as explorative vs. exploitative learning. Explorative learning is defined as a firm’s tendency to invest resources in gaining entirely new knowledge, skills, and processes, with the objective of attaining flexibility and novelty in product innovation; while exploitative learning is defined as a firm’s tendency to investment resources to refine and deliver superior customer value (Atuahene-Gima, 2005; March, 1991). Despite the apparent differences between the two types of learning, scholars and practitioners have long believed that a well-balanced combination of the two types of learning is essential for a healthy organization (Levinthal & March, 1993; March, 1991). Too great reliance on exploration without complementary levels of exploitation can lead to “failure trap”. On the contrary, excessive reliance on exploitation without supporting levels of exploration can drive the firm into “success trap” (Levinthal et al., 1993). Both of which can be detrimental to firm’s sustained competitive advantage. However, what is less understood and less well-documented in the literature is how to reach the well-balanced combination of the two modes of learning in synergistic manners to achieve better firm performance in competitive markets, especially in emerging economies.

Another research gap in the literature is that while exploitative learning may
directly influence firm performance, we suggest that explorative learning may indirectly affect firm performance through new product development as a mediator, since the distance in time and space between the locus of learning and the locus for the realization of returns is generally greater in the case of exploration than in the case of exploitation (March, 1991). The rationale for this belief rests on our assumption that while exploration means the tendency to invest resources in gaining and exploiting entirely new knowledge, skills, and processes, this mode of learning should directly influence the firm’s innovativeness and new product development activities, while indirectly influence the firm performance via the success of NPD.

What is more, the role of the external environment on organizational learning and performance has been widely studied and acknowledged (Garg, Walters, & Priem, 2003; Levinthal et al., 1993). Environmental uncertainty describes the rate of change and the unpredictability of change in a firm's external environment (Dess & Beard, 1984). Dynamic environments are characterized by changes in technologies, variations in customer preferences, and fluctuations in product demand or supply of materials (Jansen, Bosch, & Volberda, 2006). Contingency theory stresses choosing appropriate collaborative settings for enhancing the benefits of learning in different environment contexts (Mohr & Sengupta, 2002; Simonin, 2004). Less well documented is the contingency view that explains the effectiveness of types of learning under different contextual conditions. Hence, the present study postulates that the performance impact of two mode of organizational learning will be contingent upon the external environmental uncertainty that the firm faces.
By constructing the theoretical framework among organizational learning, NPD, environment uncertainty, and firm performance together, this paper makes two specific contributions. Theoretically, by applying organizational learning theory and specifically contrast the characteristics of two types of learning and respective limitations, this paper predicts the respective relationship between both exploration-performance and exploitation-performance will be inverted U-shaped, while exploration and exploitation will work as complement to produce optimal performance, which confirms the ambidexterity hypothesis that the balance between exploitation and exploration produce superior performance. Furthermore, the mediating effect of new product development on the relationship between explorative learning and performance has been tested in order to fill up the distance in time and space between the locus of learning and the locus for the realization of returns. Moreover, followed the perspective of contingency theory, this paper suggests that the performance impact of organizational learning will be contingent upon the external environmental uncertainty.

Empirically, different from most research in this area which have been conducted in Western countries, this study focuses these relationships in Chinese context. China is an ideal setting for this study, because the great competitive pressures here force the firms to rely on both the exploitation for current profits and the exploitation for future business, and the dynamic characteristics of external environment here emphasize the significance of successful new development of products and services and flexibility. Our empirically examination, using 273 Chinese firm samples,
generally supports our previous arguments. In what is to follow, we provide the theoretical background for our argument along with testable hypotheses. This is followed by a presentation of empirical results and a discussion of the results. We end with a discussion of limitations and future research directions.

LITERATURE REVIEW AND RESEARCH MODEL

Ambidextrous learning: Exploration and Exploitation

Organizational learning is a continuous, dynamic, and interactive process for knowledge creating and exploiting between individuals, groups, and organizations (Lane & Lubatkin, 1998). Scholars have explored this using different types of learning: double loop vs. single loop learning (Argyris & Schon, 1978); generative vs. adaptive learning (Senge, 1990); acquisitive vs. experimental learning (Dess et al., 2003); and product innovation-oriented vs. production-oriented learning (McKee, 1992). Despite the diverse typologies, two distinct concepts of learning can be identified: the explorative vs. exploitative learning. This distinction suggests that double loop, generative, experimental and product-innovation learning are closely aligned with explorative learning, while single loop, adaptive, acquisitive and production-oriented learning are directly aligned with exploitative learning (Auh & Menguc, 2005).

In his pioneering article, March (1991) defines exploration as a learning mechanism which has the goal of experimentation with new alternatives, and the tendency to invest resources in gaining entirely new knowledge, skills, and processes. Exploration entails activities such as search, variation, risk-taking, discovery,
innovation, and research and development. March (1991) posits that the outcome of exploration can be difficult to measure in the short-term or directly by financial indicators. He argues that the organizational return from exploration can be uncertain, distant, and sometimes negative: “the distance in time and space between the locus of learning and the locus for the realization of returns is generally greater in the case of exploration than in the case of exploitation, as is the uncertainty.” In short, exploration might be effective but due to its long-term nature, it might lack a high degree of efficiency and certainty.

Compared with exploration, exploitation is defined as chiefly interested in refining and extending existing skills and capabilities (March 1991). The central thesis of exploitation is that it is possible to secure a comfortable position in the marketplace by committing sufficient organization's resources to ensure the current viability of the firm against its competitors. Thus, the emphasis of exploitation is on the organization refining and fine-tuning existing competencies and resources. Put another way, the emphasis of exploitative learning is on operational efficiency, achieved by engaging in similar activities more efficiently (Porter, 1996). Exploitation includes, but is not limited to, such activities as refinement, production, replication, efficiency, selection, implementation, and execution (March, 1991). The primary emphasis of this type of learning is on control, efficiency, and reliability or conformance to specification (Deming, 1981; Juran & Gryna, 1988). The returns from exploitation are typically positive, proximate, predictable and often in short-term.
Although these two types of learning are diversity in function, characteristics, and outcomes, both of them are recognized as critical for firm competitive advantage (Atuahene-Gima, 2005; Yalcinkaya, Calantone, & Griffith, 2007), and many attentions have been paid on the respective role of learning toward firm performance. Based on the concept of ambidextrous organizations, some researchers argue that a balance between exploration and exploitation is necessary for firm’s sustained competitive advantage, while exploration or exploitation alone may be detrimental to firm performance in certain circumstances (Benner & Tushman, 2003; He & Wong, 2004; March, 1991). Excessive exploration at the expense of exploitation can be costly, and can lead to “failure trap”, placing a continuous drain on the organization’s resources without immediate financial reward, as the tangible outcomes of exploration will only be realized in the distant future and then only with considerable uncertainty. On the other hand, only concentration on exploitation without exploration can drive a “success trap”, where the more certain short-term returns lead the organization to overlook the outcomes associated with exploration, thus discourages the organization from pursuing learning and development, and direct firms to focus only on the near future and potentially miss out on long-term investments and opportunities that may prove valuable. Therefore, an ambidextrous learning perspective of organization has been proposed in this paper to emphasize the synergistic role of explorative and exploitative learning to both safeguards today’s profits and secures tomorrow’s returns. Whereas solely emphasize one type of learning at the expense of the other may be detrimental to firm performance in particular situations.
New product development

New product development refers to the extent of a firm’s new product offerings, ranging from line extension, style increasing, to new-to-the-market products (Galbraith, 1973). This is theorized as a manner of building and maintaining sustainable advantages, especially in competitive and turbulent environments (Garcia, Calantone, & Levine, 2003). Many studies discuss key success factors of new product development. Some factors that include: the firm owns a high-quality new product process and design team with customer orientation; the firm is able to define new product strategy, including goals and areas of strategic focus; senior managements make the necessary resource commitment to product development; the firm have high-quality product teams, including dedicated team leader, strong and frequent communication and social interaction, quick and efficient decision making, etc.; the firm must possess an innovative climate and culture; cross-functional teams to make key marketing and manufacturing decisions; information gathering regarding market testing, customer feedback, advertising testing, etc. (Benedetto, 2003; Cooper & Kleinschmidt, 1996). We believe the new product development plays a mediating role between explorative learning and firm performance since the beneficial of exploration could only be explicitly shown by the realization of successful product development. If the new product development fails or delays after other competitors’ products, the exploration activities in advantage are largely in vain.

Environmental uncertainty: the contingency theory

Environmental uncertainty refers to the rate of change and the degree of
instability and unpredictability of the environment (Dess et al., 1984). Dynamic environments may be characterized by changes in technologies, variations in customer preferences, and fluctuations in product demand or supply of materials (Jansen et al., 2006). Dynamic environments make current products and services obsolete and require that new ones be developed, as well as produce new opportunities (Jansen, Bosch, & Volberda, 2005). To minimize this threat of obsolescence and seize this emerging opportunities, organizations need to introduce explorative learning that departs from existing products, services, and markets. Hence, in dynamic environments, we expect firms that are pursuing explorative learning are likely to increase their performance, whereas firms that are pursuing exploitative learning are likely to face difficulties to cope with new situations and often fall behind by emerging competitors. Therefore, we argue that there is moderating effect of environmental uncertainty on the relationship between types of learning and firm performance.

Based on the above discussion, Figure 1 schematically outlines our theoretical framework. The each proposed relationship will be explained in detail next.

Insert Figure 1 here

HYPOTHESIS DEVELOPMENT

Explorative learning and performance

Explorative learning enhances firm performance mainly because it increases the firm’s abilities to add new variants of knowledge to their knowledge repertoire (March 1991), thus may assimilate the new knowledge to fulfill the current and
emerging customer requirement. By providing new insights into the design of new features and benefits into products, explorative learning ensures that the new product will contain emergent ideas that may differentiate it from others and be judged superior by customers (Katila & Ahuja, 2002). Despite these advantages, there are also high risks and costs associated with solely emphasize explorative learning, such as the inefficiencies in problem solving that result too many innovative ideas but no feasible conclusion in a project. Firms may move from one new idea to the next without exploiting prior learning and experience (Levinthal and March; 1993). This may also lock the firm into a cycle in which “failure leads to search and change which leads to new failure which leads to more search and so on” (Levinthal and March; 1993). Particularly, exploration learning may lead to the development of new product, albeit fancy, incompatible with customer’s current needs. Thus, although explorative learning may be beneficial, after a certain point, it can also diminish firm performance. Thus, we propose:

**H1:** Explorative learning is inverted U-shaped related to firm performance.

**Exploitative learning and performance**

Exploitative learning, on the other hand, arises out of the need for firm to fully leverage their limited resources and existing capabilities in existing technology and product-market domains. This enables the firm to improve process and procedure efficiency by building on and replicating prior technological and product-market knowledge and experience (Shane, 2000). Thus, exploitation reduces errors in problem solving and diminishes costs in executing similar tasks and procedures.
Exploitative learning is particularly useful for the firm to overcome all kinds of problems that the firm familiar with or previously encounters. However, a high level of exploitative learning alone means that the firm lacks the volume and diversity of new knowledge to have an in-depth understanding of emerging technological and market conditions that deviate substantially from current capabilities (Benner et al., 2003). Deeper exploitation within a familiar knowledge base creates inertia, and makes the adoption of alternate, newer directions of development difficult. High exploitative learning at the price of exploration may lead to diminish firm performance because of what Ahuja and Lampert (2001) call the “success trap”, which can direct firms to focus only on the near future and potentially miss out on long-term investments and opportunities that may prove valuable. Firms that emphasize exploitation might lack the capability to adapt to significant environmental or customer taste changes, and thus the recipe that makes these firms successful in the short term might endanger their success in the long run. Thus, we propose:

H2: Exploitative learning is inverted U-shaped related to firm performance.

NPD: the mediating effect

March (1991) argues the distance in time and space between the locus of learning and the locus for the realization of returns is generally greater in the case of exploration than in the case of exploitation. Therefore, we suggest that there will be some mediating element (e.g., NPD) between the explorative learning and firm performance, while exploitative learning directly affects the firm performance. New product development refers to the extent of a firm’s new product offerings, ranging
from line extension, style increasing, to new-to-the-market products (Galbraith, 1973). Through explorative learning, the firm can increase its degree of innovation capability, introducing new products and services into the market, overcoming prior resource & capacity limitations, and enhancing both value delivery to current customers and the extension of novel products and services to new customers. Thus, new product development is seldom viable if the organization does not devote its resources and commitment to exploration. Though the success of new product development is related to some other factors, some of which can not be controlled by the firm itself, firm’s emphasizing on explorative learning do directive contributes to the possibilities of product development success.

At the same time, abundant literature has suggested that there is a positive, direct relationship between new product development and firm performance (Bayus, Erickson, & Jacobson, 2003; Li & Atuahene-Gima, 2001; Zahra, Belardino, & Boxx, 1988). A continuous stream of new product enables firms to stay ahead of their competitors (Bayus et al., 2003). The above-average profits benefit from new product introductions through increased demand stimulation, increased profit margin, lesser customer acquisition and retention costs, and first-mover advantages (Bayus et al., 2003). The high level of degree of new product development also signals greater innovativeness, which has been found to increase the firm’s long-term competitive advantage, and increase more resources and cooperation in the future business, resulting in higher performance (Hurley & Hult, 1998).

As suggested earlier, while some firms have realized positive benefits from
exploration, other firms have fallen victim to the failure trap and have actually experienced negative returns from failed product development. The implication being that, explorative learning, in and of itself, may not hold the direct answer to enhanced performance, but rather be realized through the success of the new development of products and services.

On the contrast, a concentration on exploitation without exploration discourages the organization from pursuing learning and product development, thus there is no mediating effect of NPD between exploitative learning and firm performance. Exploitative learning may directly influence the performance via the operational efficiency and leveraging existing competencies upon familiar situations. In the light of above, we suggest:


**Ambidexterity hypothesis**

Exploitative learning is geared toward improving performance in the short term, and in a more certain manner by productivity improvements and cost reduction, while explorative learning is geared toward improving performance in the long term and in a more uncertain manner by innovation and flexibility. If the firm actually strikes the balance between exploration and exploitation, in other words, excels in exploration and exploitation as orthogonal at the same time, we treat this firm as ambidextrous organization.

Existing literature show us several forms of ambidexterity, such as Brown and
Eisenhardt (1997) suggest that dynamic capabilities are rooted in rhythmically switching between more organic and more mechanistic structure. Tushman (1997) advise that ambidextrous organizations are composed of multiple tightly coupled subunits that are themselves loosely coupled with each other, while within subunits the arrangement are consistent, but across subunits the arrangements are inconsistent, and these highly differentiated but loosely coupled subsystems integrated strategically by the senior team. Levinthal and Gavetti (2000) suggest senior managers create a dual organization structure through consistently transformation as they steer a balance between the need to be small and large, centralized and decentralized, and focused on the short term and long term. Gupta et al. (2006) suggest when subsystems interact with each other via modular interfaces, the task of balancing exploration and exploitation can be delegated to the higher-level systems, and each subsystem can focus on just exploration or just exploitation without any major threats to long-run performance. Burgelman (2002) suggests punctuated equilibrium, or temporal cycling between long periods of exploitation and short bursts of exploration, is an alternative balancing mechanisms for ambidexterity. Gibson and Birkinshaw (2004) propose that contextual ambidexterity, whereby organizations encourage individuals to make their own choices as to how they divide their time between exploration and exploitation in unit level, is a viable way of ambidexterity. Benner and Tushman (2003) take HP Inc. as an example: when the Scanner Division’s general manager and his senior team provided the integration between the unit’s two highly differentiated subunits, the division was able to effectively both explore and exploit. However, when
this general manager was promoted, the new executive did not deeply understand the competitive issues in the scanning industry, he cancelled the more exploratory unit when it did not show quick profits. In sum, successful ambidexterity can be achieved by structural ambidexterity, which involves ambidextrous design (certain units are responsible for exploration, and others are designated for exploitation, which integrated strategically by the senior team) or punctuated equilibrium (temporal cycling between long periods of exploitation and short bursts of exploration), or by contextual ambidexterity, whereby business-units encourage, discipline and trust individuals to make their own choices as to how they divide their time between explorative- and exploitative- oriented activities.

Since the simultaneously excel the exploration and exploitation is both viable and can overcome the respective shortcoming of over-reliance on either one type of learning, we argue that an ambidextrous firm that is capable of operating simultaneously to explore and exploit is likely to achieve superior performance than firms emphasizing one at the expense of the other. Moreover, according to Katila and Ahuja (2002), exploitation of existing capabilities is often needed to explore new capabilities, and exploration of new capabilities also enhances a firm’s existing knowledge base. The rationale for this belief rests on the absorptive capacity literature about how firms can use their accumulated knowledge to recognize and assimilate new knowledge (Cohen & Levinthal, 1994). Existing knowledge may facilitate both absorption and development of new knowledge, suggesting a positive possibility between explorative learning and exploitative learning. These arguments
for complementarity suggest the combination of exploration and exploitation should generate higher performance than either learning mode in isolation. Therefore, we suggest:

H4: Explorative learning and exploitative learning work as complements. In other words, the ambidextrous firm enjoys the higher performance.

Environmental uncertainty: the contingency effect

Environmental uncertainty, and in particular demand and technological uncertainty, increases the importance of innovation and relative NPD activities (Brown et al., 1997; Teece, Pisano, & Shuen, 1997). Periods of environment ferment are characterized by substantial product variation and market uncertainty. Responding to environmental uncertainty and variation requires similar variety within the firm as contingency theory anticipates (Daft & Weick, 1984). Organizational outcomes are often affected by inadequate or delayed responses to environmental change (Henderson, 1993). For example, IBM’s relatively slow response to PC resulted in the successful entry of other small but less inertial competitors that fundamentally changed the nature of the computer industry (Mitchell, 1989). Zahra (1996) suggests that in technologically uncertainty environments, emerging opportunities are more common than in environments with lower level of technological uncertainty. The abundance of these opportunities increases the potential benefits and possibilities of success from explorative learning (Baysinger & Hoskisson, 1989). Organizations that pursue such innovations can capitalize on changing circumstances by creating new products and services or meeting the needs
of premium market segments and new niches (Levinthal et al., 1993; Lumpkin & Dess, 2001; Zahra, 1996).

On the other hand, a high level of environmental uncertainty also increases the potential risks associated with an overemphasis on exploitative learning. In environments with more uncertainty, the firms face a greater risk that their core competences become rapidly obsolete, in other words, they are likely to fall behind because they become consistently better at performing routines that are less and less valued by the environment (Sorensen & Stuart, 2000). This constrains a firm’s capacity to continually exploit its existing capacities and promising opportunities. Slow or incompetent responses to environmental shifts prevented incumbents from retaining their leadership positions in the disk drive (Christensen & Bower, 1996), photolithographic equipment (Henderson & Clark, 1990), watch (Glasmeier, 1991) industries, among others (Tushman, 1997). Burgelman (1994) also suggests that a reduction in variance-increasing activity within the firm prevents it from responding to environmental uncertainty. In the light of above, we suggest:

H5a: Environmental uncertainty positively moderates the relationship between explorative learning and firm performance.

H5b: Environmental uncertainty negatively moderates the relationship between exploitative learning and firm performance.

METHODOLOGY

Data collection

The questionnaire was developed on the basis of a thorough literature review.
All items in the questionnaire stemmed from empirical studies cited earlier. This not only increased the reliability and validity of survey items, but also made the questions more appealing and easy to understand. We pre-tested the survey instrument with 6 firms in Xi’an Hi-tech Development Zone, China. The interviews, which were semi-structured and lasted for about one hour allowed us to modify the language suitability, clarify the survey items, and reject items that were misleading.

We took a data collection approach similar to that proposed by Simonin (1997). The informants were selected by using two key criteria: (1) people that recognize and assess the strategy and performance-related issues, and (2) people that specialized organizational learning or NPD activities. We chose firm’s senior managers as informants in this study. Questionnaires were sent to the senior managers of 700 firms in China, with an explanation of the objectives and requirements of this survey and a promise that we would not give others the information that their firms provided.

Every set of questionnaires involved three parts – a copy of the questionnaire, a guide for completing the questionnaire, and a return envelope. With three-round reminders (calls, e-mails and re-mailing), responses with missing data as well as doubtful or contradictory answers that could not be clarified were removed from the sample. A total of 273 valid responses were achieved at the end of the surveys, yielding response rates of 39%. We found no significant differences between early and late respondents using the Kolmogorov-Simirnov two-sample test. The sample firms represented a wide range of industries such as automobile, equipment, pharmaceuticals, chemicals, biotechnology, electronics, semiconductors, and Information Technology.
Geographically, our survey comprises sample firms nationwide, covering most regions and provinces in China.

The senior managers in our sample averaged 46 years of age (S.D. 10.6), and had been employed by the firm for 9 years (S.D. 5.7). Based on the managers’ positions and their experience, as key informants these senior managers should be reasonably well informed about our focal constructs. Because relying on single respondents may introduce a common method bias, however, we performed the confirmatory factor analysis and found no traces of such bias as the goodness-of-fit indices indicated a poor fit for the single-factor model. In order to minimize the social desirability bias, we maintained full anonymity for all informants throughout the survey process. We also followed the measures suggested by Fisher (1993) and used more specific and less direct questioning to reduce the social desirability bias. In our cover guide, we informed the respondents that the survey was designed for research only and that there was no right or wrong answer to our question. Finally, we checked the non-response bias by using procedures introduced by Armstrong and Overton (1977). We randomly chose from 30 firms that had not replied to the questionnaire and asked for information concerning firm attributes such as size, sales, location, and ownership. All t-statistics of comparison between responding and non-responding firms were non-significant.

**Measures**

Multi-item scales were used to operationalize all the constructs. The measures employed the 5-point Likert items with end points of “strongly disagree” and
“strongly agree”. We used the back-translation method to ensure comparability between items included in the newly constructed questionnaire and their original formats in English to rule out any problems arising from idiomatic or colloquial wording (Parameswaran & Yaprak, 1987). The detailed measurement items used for each construct are summarized in Table 2.

**Explorative learning (ER)** was measured with five items, five-point Likert scale ($\alpha=0.898$) adapted from Zahra et al. (2000) and Atuahene-Gima (2005). **Exploitative learning (EI)** was conceptualized with five items, five-point Likert scale ($\alpha=0.864$) adapted from Zahra et al. (2000) and Atuahene-Gima (2005). We conceptualized the **new product development (NPD)** as the change in emphasis on product or service innovation on a five-point Likert scale (from no change to very large change). The three items that adapted from Dewar and Dutton (1986) included (1) expanding the new category of products/services, (2) promoting the new products/services into the market, and (3) expanding the scope of business through NPD ($\alpha=0.928$). Adapted from Jansen et al. (2006), four items were incorporated to measure the **environmental uncertainty (EU)** ($\alpha=0.824$). The dependent variable, **firm performance (P)** was measured with five items that required the senior management respondents to reflect on performance over the last three years and indicate the degree to which they agreed with the following (1) sales growth, (2) profit growth, (3) market share growth, (4) market area extension, and (5) market position improvement compared to its competitors ($\alpha=0.846$). The detailed items of all constructs were shown in table 2.

**Control variables.** In the empirical study, we controlled for possible confounding
effects by including various relevant control variables. Because larger firms may have more resource yet may lack the flexibility to explore, we included firm size as measured by a five-point scale. A firm’s age, measured by the number of years from its founding, was also included. Senior manager’s industry experience referred to the average number of years that a firm’s senior managers have spent in the current industry. We take it as the final control variable.

Reliability and Validity

The correlations, means and standard deviations for all the constructs that were finally used are indicated in Table 1.

Insert Table 1 about Here

The second step involved reliability analysis of multiple items for each construct. Content validity was assured by a comprehensive review of the literature and adoption of existing scales, whenever possible. In every instance, the Cronbach α of each construct was over 0.70 (see Table 2), showing high internal consistency for each of these variables (Cronbach, 1951; Nunnally, 1994). The results showed that the factor loading of every item was above 0.729, indicating construct validity. Then, following Bagozzi and Yi (1988), we also computed composite reliability (CR) scores to assess construct validity. As reported in Table 2, all factors have CRs greater than 0.70, indicating acceptable levels of validity for the constructs (Fornell & Larcker, 1981). The AVE values for all constructs satisfactorily exceed 0.50, indicating convergent validity (Fornell & Larcker, 1981).

Insert Table 2 about Here

Finally, we chose two constructs randomly and compared the change in
chi-square to test the discriminant validity. The results showed a significant
difference between the chi-square of the two constructs, indicating that the constructs
have good discriminant validity. As an alternative test, we conducted the procedure
recommended by Fornell and Larcker (1981). The squared correlation between each
pair of constructs is less than the AVE for each individual construct. These results
collectively provide strong evidence of discriminant validity.

**Regression Results**

The hypotheses were tested using hierarchical regression, where the dependent
variable was firm performance and NPD. In order to mitigate the potential for
multicollinearity, the independent variables were mean-centered prior to the
regression analysis (Aiken & West, 1991). The values of the variance inflation
factor (VIF) are well below the cut-off of 10 recommended by Neter et al. (1985).
Following the recommendations of Cohen (2003), the variables were entered into the
model in several steps: control variables, main effect variables, three steps for
mediating effect test, interaction items and moderating variables. The results of each
step are shown in Table 3.

**Insert Table 3 about Here**

In the first step, the control variables were entered into the equation. As
expected, the regression equation was significant (F value =2.102, p<0.05). The
control variables include firm size (β= 0.043), firm age (β= 0.063) and senior
manager’s industry experience (β= 0.118, p<0.05). Next, the main independent
variable were entered into the regression equation, and the resulting equation was
significant (F value = 3.926, p<0.001). The adjusted R² value increased significantly from Model 1 to Model 2, indicating significant main effects. The results suggested that explorative learning is inverted U-shaped related to firm performance (β = 0.110, p<0.05; β of square = -0.125, p<0.01), thus supporting hypothesis 1; while exploitative learning is also inverted U-shaped related to firm performance (β = 0.137, p<0.001; β of square = -0.134, p<0.01), thus supporting hypothesis 2. In the third to fifth step, the mediating effect of NPD between explorative learning and firm performance was tested. In model 3, the relationship between explorative learning and NPD was inverted U-shaped (β = 0.275, p<0.001; β of square = -0.115, p<0.05). In model 4, the NPD was positively related to firm performance (β = 0.256, p<0.001). And in model 5, both the explorative learning and NPD were entered into the equation, which showed the partially mediating effect of NPD between explorative learning and firm performance (β of explorative learning = 0.108<0.275, p<0.05; β of NPD = 0.205, p<0.001), thus hypothesis 3 was supported. In the next step, the interaction item of explorative learning * exploitative learning was entered into the equation, and the overall model was significant (F value = 3.633, p<0.001), where the adjusted R² value increased slightly from previous models, indicating interaction effects. The results of model 6 showed that the coefficient of interaction item is positive and significant (β = 0.116, p<0.05), thus supporting hypothesis 4. Finally, the moderator variable, environmental uncertainty, and two moderating items were entered into the equation, and the overall model was significant (F value = 4.231, p<0.001). Model 7 showed that the coefficient of environmental uncertainty * explorative learning is positive and
significant ($\beta = 0.235, p<0.001$), while the coefficient of environmental uncertainty * exploitative learning is negative and significant ($\beta = -0.247, p<0.001$). Thus, hypothesis 5a and 5b were supported.

**DISCUSSION**

In this study, our underlying theme was to gain a greater understanding of the synergistic effects of exploration and exploitation and the resultant influence on the firm performance, as well as the mediating effects of NPD and moderating effects of environment uncertainty in emerging economies. As such, the results provide substantive theoretical and practitioner insights for academics and practitioners.

The findings of this study indicate that explorative learning and exploitative learning have unique influence on firm’s performance. Specifically, the findings indicate that explorative learning primarily leads to innovation and flexibility, and great a reliance on exploration without complementary levels of exploitation can lead to failure trap, whereas exploitative learning primarily leads to cost deduction and direct profits and reliability, and excessive reliance on exploitation without supporting levels of exploration can drive the firm into success trap. Not only do the results confirm our theorized inverted U-shaped relationships of two learning and firm performance, but also extend our theoretical understanding of this issue because the extant literature less well-documents how to reach the well-balanced combination of learning in synergistic manners to achieve better firm performance, especially in emerging economies.

The findings also provide insights into the mediating effects of NPD on the
exploration-performance relationship. Explorative learning would indirectly influence the firm performance through the success of new product development. The distance in time and space between the locus of learning and the locus for the realization of returns is fulfilled by the process of new product development.

Next, the findings indicate the ambidexterity hypothesis that exploration and exploitation work as complement rather than substitute for firms in emerging countries. Successful business firms are those who able to simultaneously develop explorative and exploitative learning. The way of successful ambidexterity might either be structural ambidexterity, which involves ambidextrous design (certain units are responsible for exploration, and others are designated for exploitation, which integrated strategically by the senior team) or punctuated equilibrium (temporal cycling between long periods of exploitation and short bursts of exploration), or be contextual ambidexterity, whereby business-units encourage, discipline and trust individuals to make their own choices as to how they divide their time between exploration and exploitation.

Our findings also provide substantial support for the nature of the external environment as an important role in the effectiveness of learning. We provide insights regarding how organizations cope with various contexts. Specifically, results suggest that firms operating in more dynamic environments increase their performance by pursuing exploratory learning and new product development. They resist the threat of obsolescence of competences by innovating and entering new markets. On the other hand, exploitation of existing products, services and markets
appear to fall behind in dynamic context as they try to leverage and improve capacities for markets that are in decline or out of date. Hence, the empirical findings contribute to previous literature about the environmental moderators.

**Managerial implications**

Managerially, one obvious implication is the need for senior managers to become more explicitly aware of the need to allocate resources between explorative and exploitative learning simultaneously as an avenue to maintain and develop the firm’s performance. Several mechanisms that may be helpful, such as ambidextrous design, punctuated equilibrium, and contextual ambidexterity, to achieve the exploration-exploitation balance are proposed.

The findings also suggest that managers should recognize that NPD serves as a mediator between exploration and firm performance. Specially, although exploration can influence firm performance, its influence is indirect, and mainly through the success of new development of products and services. Thus, managers must carefully monitor and manage the new product introduction process in order to increase the successful probability of innovation and initiatives.

Next, despite the powerful institutional pressures and promise of legitimacy to more rely on exploitation, managers need to exercise great care in when and where to balance the exploitation with exploration. Whereas in stable, technologically and customer preference certain settings exploitation may be productive and cost efficient, in uncertain or environmental complex contexts exploitation may be less productive than exploration. Therefore, encouraging a supportive organizational context that
generates simultaneous capacities for exploration and exploitation may be a key source of competitive advantage for leaders in the 21st century.

**Limitations and future directions**

Although this study provides several new insights into the understanding of organizational learning, NPD and environmental uncertainty, as with prior studies, it is subject to some limitations. First, although the findings suggest that ambidextrous firm enjoy better performance, potential antecedents that may promote ambidexterity in different contexts is not systematically touched in this study. It could be argued that strategic orientation, organization culture or senior executive support may have an important role for firm to become more ambidextrous. A promising extension of our study would be more systematically examine the behaviors of senior executives and heterogeneity of senior teams in an effort to understand how they help create ambidexterity.

Next limitation lies in the unique context of the study, China. As with most research, generalization beyond the sample frame is highly cautioned. The findings are limited to the institutional context of China. It could be argued that different relationships between organizational learning and firm performance, or the role of environment could exist in alternative institutional contexts. For example, in an economy in which intellectual property laws are more stringently enforced, the beneficial role of exploration may be more prominent. Furthermore, it could be argued that institutional elements, such as national culture or government policy orientation, may drive a firm’s ability or desire to develop and maintain particular
organizational learning. As such, we believe that the extension of this basic model to a multicountry or multiarea context would substantially enhance the understanding of the issues addressed herein at a broader level.

Another limitation of this study derives from its cross-sectional design, which means causality cannot be established. Thus, these relationships should be examined longitudinally. Exploring this issue longitudinally would also provide additional insights into the underlying model proposed. For example, during different life-cycle of organizations, exploration or exploitation would have unique effects on firm performance. Exploration might take on a more important role during initial market penetration than in later stages, when the firm has an established market position on which to undertake the greater risk and resource requirements associated with explorative learning. As such, more research in this area could overcome the limitations of existing models.

CONCLUSION

Overall, the results of this study provide a more comprehensive theoretical and empirical foundation for understanding the unique influence of explorative and exploitative learning on firm performance under the contingency of environment uncertainty. The findings also suggest that the effect of explorative learning on firm performance is indirect through the success of new product development. Such research and the researches that follow are necessary and important if researchers and business practitioners are to learn how organization can more effectively learn, adapt, innovate and survive in the dynamic markets.
REFERENCES


Christensen, C. M. & Bower, J. L. 1996. Customer power, strategic investment, and


Yalcinkaya, G., Calantone, R. J., & Griffith, D. A. 2007. An Examination of


Figure 1 Conceptual model

Explorative learning

H3

New product development

Firm performance

Exploitative learning

H2

Environmental uncertainty

H4

Explorative learning * exploitative learning

H1

H5a +

H5b -

H5a +
<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<td>1 Explorative learning</td>
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<td>2 Exploitative learning</td>
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<td>.794</td>
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<td></td>
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<tr>
<td>3 New product development</td>
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<td>.054</td>
<td>.912</td>
<td></td>
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<td>4 Firm performance</td>
<td>.103*</td>
<td>.176**</td>
<td>.212**</td>
<td>.830</td>
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<td>5 Environmental uncertainty</td>
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<td>6 Firm size</td>
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<td>.105*</td>
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<td>7 Firm age</td>
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<td>.007</td>
<td>.285**</td>
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<td>8 Senior manager’s industry experience</td>
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<td>.056</td>
<td>.110*</td>
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<td>.016</td>
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<td>Mean</td>
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<td>3.45</td>
<td>3.12</td>
<td>3.74</td>
<td>3.64</td>
<td>2.57</td>
<td>16.47</td>
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<tr>
<td>Standard Deviations</td>
<td>0.54</td>
<td>0.46</td>
<td>0.59</td>
<td>0.66</td>
<td>0.74</td>
<td>0.42</td>
<td>15.56</td>
<td>7.56</td>
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</table>

Notes: ** Correlation is significant at the 0.01 level (two-tailed); * Correlation is significant at the 0.05 level (two-tailed). The number in the diagonal is the square root of AVE.
Table 2 Constructs, Reliability and Validity

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Cronbach α</th>
<th>Loading</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explorative learning (ER)</strong></td>
<td>0.898</td>
<td></td>
<td>0.930</td>
<td>0.726</td>
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<tr>
<td>Acquired manufacturing technologies and skills entirely new to the firm</td>
<td></td>
<td>0.812</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learned product development skills and process entirely new to the industry</td>
<td>0.854</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquired entirely new managerial and organizational skill that are important for innovation</td>
<td>0.850</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learned new skills in areas such as funding new technology, staffing R&amp;D function for the first time</td>
<td>0.897</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strengthened innovation skills in areas where it had no prior experience</td>
<td>0.845</td>
<td></td>
<td></td>
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<tr>
<td><strong>Exploitative learning (EI)</strong></td>
<td>0.864</td>
<td>0.895</td>
<td>0.630</td>
<td></td>
</tr>
<tr>
<td>Upgraded current knowledge and skills for familiar products and technologies</td>
<td></td>
<td>0.803</td>
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<td></td>
</tr>
<tr>
<td>Invested in enhancing skills in exploiting mature technologies that improve productivity of current innovation operations</td>
<td>0.785</td>
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<td></td>
</tr>
<tr>
<td>Enhanced competencies in searching for solutions to customer problems that are near to existing solutions rather than completely new solutions</td>
<td>0.819</td>
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<tr>
<td>Upgraded skills in product development processes in which the firm already possesses significant experience</td>
<td>0.747</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Strengthened our knowledge and skills for projects that improve efficiency of existing innovation activities</td>
<td>0.812</td>
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<td></td>
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<tr>
<td><strong>New product development (NPD)</strong></td>
<td>0.928</td>
<td>0.937</td>
<td>0.832</td>
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<tr>
<td>Expanding the new category of products/services</td>
<td></td>
<td>0.912</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promoting the new products/services into the market</td>
<td></td>
<td>0.926</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expanding the scope of business through NPD</td>
<td></td>
<td>0.898</td>
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<tr>
<td><strong>Firm performance (P)</strong></td>
<td>0.846</td>
<td>0.917</td>
<td>0.689</td>
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<td>Sales growth</td>
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<td>Metric</td>
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<td>------------------------------------</td>
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<tr>
<td>Profit growth</td>
<td>0.846</td>
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<tr>
<td>Market share growth</td>
<td>0.782</td>
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<td>Market area extension</td>
<td>0.795</td>
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<tr>
<td>Market position improvement</td>
<td>0.847</td>
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<tr>
<td><strong>Environmental uncertainty (EU)</strong></td>
<td>0.824</td>
<td>0.847</td>
<td>0.582</td>
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<tr>
<td>In our local market, changes are taking place continuously</td>
<td>0.760</td>
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<tr>
<td>Our clients regularly ask for new products and services</td>
<td>0.804</td>
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<tr>
<td>In our market, the volumes of products and services to be delivered change fast and unpredictable</td>
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<tr>
<td>Environmental changes in our local market are intense</td>
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Notes: CR refers to composite reliability, while AVE refers to average variance extracted.
Table 3 Regression model results (N=273)

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
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<tr>
<td></td>
<td>Performance</td>
<td>Performance</td>
<td>NPD</td>
<td>Performance</td>
<td>Performance</td>
<td>Performance</td>
<td>Performance</td>
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<td>Firm size</td>
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<td>-.073</td>
<td>.171**</td>
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<td>.028</td>
<td>.022</td>
<td>.035</td>
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<tr>
<td>Firm age</td>
<td>.063</td>
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<td>-.097</td>
<td>.117*</td>
<td>.054</td>
<td>.024</td>
<td>-.015</td>
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<tr>
<td>Senior manager’s industry experience</td>
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<td>.135*</td>
<td>.137*</td>
<td>.145**</td>
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<td>.101*</td>
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<td>Explorative learning</td>
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<td>.275***</td>
<td>.108*</td>
<td>.108*</td>
<td>.104*</td>
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<tr>
<td>Explorative learning squared</td>
<td>-.125**</td>
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<td>.004</td>
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<td>Exploitative learning</td>
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<td>.054</td>
<td>.115**</td>
<td>.117*</td>
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<tr>
<td>Exploitative learning squared</td>
<td>-.134**</td>
<td>.008</td>
<td>-.085</td>
<td>-.097</td>
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<td>New product development</td>
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<td>.205***</td>
<td>.115**</td>
<td>.154**</td>
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<tr>
<td>Explorative learning *</td>
<td></td>
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<td>.116*</td>
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<tr>
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<td>Environmental uncertainty</td>
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<td>Adjusted R Square</td>
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<td>.116</td>
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<td>F Value</td>
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<td>3.926***</td>
<td>3.721***</td>
<td>3.422***</td>
<td>3.848***</td>
<td>3.633***</td>
<td>4.231***</td>
</tr>
</tbody>
</table>

Notes: * p < 0.05; ** p < 0.01; *** p < 0.001