EXPLORATIVE VERSUS EXPLOITATIVE ALLIANCES—EVIDENCE FROM THE GLASS INDUSTRY IN CHINA

Leung, Vincent K.K. and Lau, Chi Keung Marco and Zhang, Zhe

United International College, Northumbria University, Kentucky University

5 January 2013

EXPLORATIVE VERSUS EXPLOITATIVE ALLIANCES—EVIDENCE FROM THE GLASS INDUSTRY IN CHINA

Vincent K.K. Leung [1] , Marco Chi Keung Lau[2], and Zhe Zhang[3]

ABSTRACT

This study empirically delineates the nature of explorative and exploitative alliances, examines how they affect product and process innovations, and investigates how such effects vary in different contexts. Using a sample of 220 Chinese firms in the glass industry, we find that explorative alliances have a stronger effect on both product and process innovations than exploitative alliances. Product and process innovations are positively related to both market and efficiency performance and environmental turbulence enhances the effect of product and process innovations. Our findings provide implications on how to choose between explorative and exploitative alliances relative to the alliance objectives and firm resources and environmental contexts.

Keywords: China, exploration versus exploitation, structural equation modeling, process innovation, product innovation, small-and-medium-sized enterprises
JEL Codes: D21, D7, N60, L65

1 PhD, Asst. Professor of Economics, Division of Business and Management, BNU-HKBU United International College Zhuhai, China
Email: vincentleung@uic.edu.hk
2 PhD, Senior Lecturer of Economics and Finance, Northumbria University, Newcastle Business School, Newcastle, UK.
Email: kenlau123@hotmail.com
3 PhD, Asst. Professor of Management, School of Business Eastern Kentucky University 521 Lancaster Avenue BTC 011, Business & Technology Center Richmond, KY 40475
Email: zhe.zhang@eku.edu

INTRODUCTION

Strategic alliances have become increasingly prevalent in the hypercompetitive and dynamic marketplace (Gulati, 1998; Hoang & Rothaermel, 2005; Rothaermel & Deeds, 2004). Previous research has identified important factors that drive alliance formations, such as market uncertainty, resource dependence, skill heterogeneity, and imperfect factor markets (Varadarajan & Cunningham, 1995, p. 85). However, little is known on the issue of how firms choose one specific type of alliances over the others.

This study focuses on two types of alliances—explorative and exploitative alliances. These two types of alliances are qualitatively different in that the explorative alliance focuses on the search for new knowledge, whereas the exploitative alliance emphasizes on refining and extending existing knowledge (Koza & Lewin, 1998; Lavie & Rosenkopf, 2006; Rothaermel, 2001a, 2001b). Surprisingly, few attempts have been made to conceptualize and operationalize these two types of alliances. In the present study, we aim to provide a better conceptualization and innovative operationalization of the explorative and exploitative alliances.

Moreover, although previous research has studied the effects of alliances on product innovation, little is known about how alliances affect product and process innovations (Hauser, Tellis, & Griffin, 2006). In the present study, we investigate the different effects of the explorative and exploitative alliances on the product and process innovations, thus offering an additional perspective on managing different types of innovation.

Finally, as the product and process innovations may lead to systematically different performance outcomes, we use the market and efficiency performance to examine empirically the issue. Their outcomes are also evaluated in the context of different environmental factors to increase the generalizability of our findings.

Specifically, this study aims to accomplish the following: (1) delineate the nature of explorative and exploitative alliances, (2) explain their influence on the firm performance through product and process innovations, and (3) examine how three environmental factors, namely, market turbulence, competitive intensity, and technological turbulence, moderate the effects of both product and process innovations. The conceptual model of this study is shown in Figure 1.

("Figure 1 goes about here")

CONCEPTUAL FRAMEWORK AND HYPOTHESES

Effects of Explorative and Exploitative Alliances on Product and Process Innovations

Previous literature has established that strategic alliances drive innovation and are a popular mode of external knowledge acquisition (Vanhaverbeke, Duysters, & Noorderhaven, 2002). Given limited resources, explorative and exploitative alliances may create conflicts between each other but can also act synergistically (Gupta, Smith, & Shalley, 2006; He & Wong, 2004; Lavie & Rosenkopf, 2006; Sidhu, Commandeur, & Volberda, 2007). Ancona et al.(2001, p. 568) argued that firms may engage simultaneously in exploitation and exploration. In fact, according to Katila and Ahuja (2002), exploitation of existing capabilities is often needed to explore new capabilities, and the exploration of new capabilities improves a firm's existing knowledge base. These reports suggested that exploration and exploitation are likely to form cross paths in influencing innovation; they are not mutually exclusive.

We argue that firms will gradually lose their competitive advantages if they remain satisfied with their existing products, processes, and knowledge. They can only keep abreast with keen competition if they strive for innovation that focuses on processes, products, or both. They may think that this objective can only be achieved by forming an alliance. When alliance partners decide to participate in an explorative or an exploitative alliance, they have to engage in activities that they expect will improve their performance and lead to greater success. Firms in explorative or exploitative alliances learn from each other, and innovations are the outcomes of the learning process.

The value of explorative alliances lies in bringing new products to the market. On the other hand, the value of exploitative alliances lies in achieving higher accuracy, better quality, and lower costs in production or managerial process. Explorative alliances focus on searching, experimenting, and undertaking calculated risks to accomplish long-term objectives. The types of activities undertaken by explorative alliances are upstream and research oriented. This type of alliance often involves partners from horizontal ties, such as R&D institutions or companies from unrelated industries. A notion has been well established that explorative alliances positively influence product innovation (Isobe, Makino, & Montgomery, 2008). Interestingly the findings of He and Wong (2004) showed that exploitative alliances can also lead to product innovation. According to the knowledge-accessing theory, knowledge-acquiring alliances (explorative alliances) often need a longer time to launch new products to the market and require higher costs and risks compared with knowledge-accessing alliances (exploitative alliances) (Grant & Baden-Fuller, (2004, p. 76). Firms may opt to form an alliance to access knowledge that they can immediately apply to their products, rather than spend time acquiring new knowledge. Both explorative and exploitative alliances can have positive effects on product innovation. Rothaermel and Deeds (2004) noted that an explorative alliance has a more significant effect on product innovation than an exploitative alliance. In the light of the previous research on explorative and exploitative alliances, we make the following hypothesis:

Hypothesis 1. Both (a) explorative and (b) exploitative alliances have positive effects on product innovations; however, (c) the effects of explorative alliances are stronger.

Exploitative alliances focus on short-term objectives, refinement, efficiency, and implementation (March, 1991). The types of alliance activities that exploitative alliances focus on are more downstream and development oriented (Rothaermel & Deeds, 2004). Exploitative alliances often refer to the partnering relationships of a vertical tie, for example, between customers and suppliers within the industry (Mesquita & Lazzarini, 2008). Refinement is considered an exploitative activity (March, 1991). Firms that engage in refinement activities are often involved in process development (Isobe, Makino, & Montgomery, (2008). Process innovation or development can involve production, opening new markets, servicing, or human resources.

He and Wong (2004) noted that the exploitative approach may also lead to product innovation in conjunction with the process innovation. Rothaermel (2001b) gave one example wherein a well-established firm, for explorative motivational reasons, may choose to form an alliance with a newcomer who has developed new products based on new technology and wants to bring them to the market. Although the incumbent firm has the marketing capability, it may need to work with the newcomer to refine the marketing process and make it suitable for the new product. This case is an example of an explorative alliance-driven process innovation where a new technology or product called for a remarkable development of an existing process, which is compatible with the new technology or product. Based on the previous research, we hypothesize the following:

> *Hypothesis 2. Both (a) explorative alliances and (b) exploitative alliances have positive effects on the process innovation; however, (c) the effect of explorative alliances is stronger.*

Effects of Product and Process Innovations on the Market and Efficiency Performance

The literature has established that innovation is a source of competitive advantage, which improves the firm performance (Brown & Eisenhardt, 1995). Firms need to introduce new products to stay competitive and meet the expectation of their customers (Yli-Renko &

Janakiraman, 2008). When a firm introduces a new product, it expects improvements in its market performance, which is usually gauged by the market share and sales growth. When the benefits of product innovation outweigh its costs, firms can enjoy positive returns. Innovative products that perform better than the existing ones will generate good returns on investment if they are reasonably priced and have a sufficiently high quality to maintain their sales.

When a firm develops a new process, it expects the benefits of lower cost, higher throughput, or better quality in the manufacturing setting. For example, a firm may use an innovative process applied to its existing IT knowledge to provide better customer services. Firms may also engage in process innovation to improve the quality or speed up the production lead time in a current process. A shorter lead time is vital in manufacturing. These kinds of process innovations give a firm a competitive advantage, that is, improve its efficiency performance.

However, the relationships described are mostly conceptual (Brown & Eisenhardt, 1995; Siguaw, Simpson, & Enz, 2006) and lack empirical support. Moreover, most of the previous quantitative studies on performance have focused on proving the links between other antecedents and the firm and alliance performance (Combs & Ketchen Jr, 1999; Emden, Yaprak, & Cavusgil, 2005; Kandemir, Yaprak, & Cavusgil, 2006; Lu & Beamish, 2001; M. B. Sarkar, R. A. J. Echambadi, & J. S. Harrison, 2001b; Wu & Cavusgil, 2006); the relationship of the product and process innovations with the market and efficiency performance has rarely been studied. Among the research papers in this area, He and Wong (2004) noted that both product and process innovations positively influence sales or market performance. They used sales performance as the sole indicator because it is easy, reliable, and error-free, and it can be used as a proxy for other performance. Isobe, Makino, and Montgomery (2008) extended the research on these links by proving that refinement capability (exploitation) is positively related to operational (or efficiency) performance, and reconfiguration capability (exploration) is positively related to the strategic (or market) performance. However, Wolff and Pett (2006) did not find a significant link between process innovation and growth performance in their study.

The returns associated with product innovation are uncertain and may be distant in terms of time because the innovation–production time lag may retard the realization of benefits from the product innovation. However, product innovation is regarded as market oriented, and we would therefore expect its effect on the market performance to be positive. Based on this argument, we hypothesize the following:

Hypothesis 3. Product innovation has a positive effect on the market performance.

The outcomes of the exploitation activities are more certain and much more quickly implemented (Levinthal & March, 1993; March, 1991). We can therefore assume that the effect of process innovation on the efficiency performance is positive. Process innovation usually brings faster and more observable returns, such as improvements in efficiency (Isobe et al., 2008), manufacturing process or quality, and customer service quality. Based on this argument, we present the following hypothesis:

Hypothesis 4. Process innovation has a positive effect on the efficiency performance.

Moderating Effects

When a firm fails to respond to the changing needs in the market, it will likely see a decrease in sales and profit and cease to be in business. March (1991) argued that at such times of market turbulence, firms are averse to undertaking product innovation because they are concerned with the innovation–production time lag. He pointed out that only firms that sell products with a longer product cycle are willing to undertake product innovation in times of market uncertainty. However, Zhou, Yim, and Tse (2005) found that demand uncertainty has a positive effect on innovation, whereas Hauser, Tellis, and Griffin (2006) believed that in a market with high turbulence, where customers demand new products or upgrades, pressure is naturally put on product innovation rather than on process innovation. They posited that turbulence has a positive effect on innovation. The first-move-advantage argument may explain why the effect is positive (Grant & Baden-Fuller, 2004). If a firm can introduce a new product quickly enough to keep up with market turbulence, the time lag effect may be insignificant. Extending this thought, merely refining the processes without having new products will not enable a firm to keep up with the pace of market change. Investment in improving a process that produces an outdated product is not meritorious. Basing our assumptions on previous research, we hypothesize the following:

> *Hypothesis 5. Market turbulence (a) strengthens the effect of product innovation on market performance but (b) weakens the effect of process innovation on efficiency performance.*

When competition is intense, one way for firms to survive is to differentiate them from the competition. Competition acts as a catalyst for improvement among firms. Hauser, Tellis, and Griffin (2006) noted that strong competition has a positive effect on the innovation, and March (1991) argued that more competition leads to more exploration and, ultimately, to more product innovation. Another way for firms to react to intensive competition is to operate at lower costs compared with their competitors. Price cuts are, however, likely to have a negative effect on the efficiency performance because less money would be available for investment in process innovations that could lead to improvements in efficiency performance. Taking into account the previous research, we hypothesize the following:

> *Hypothesis 6. Competitive intensity (a) strengthens the effect of product innovation on the market performance but (b) weakens the effect of process innovation on the efficiency performance.*

In a technologically turbulent environment where products that rely on technology change very rapidly (for example, mobile phones and digital cameras) or processes become swiftly outdated (for instance, semiconductor technology in electronics), firms must constantly race against time to introduce innovatory products and processes. March (1991) argued that, similar to the case of the competitive intensity, a faster pace of technological change leads to more exploration. We contend however that this exploration must embrace both product and process innovations; when technology changes rapidly, in order for new products to keep up successfully with the pace of change; innovatory processes must be in place to ensure efficient performance of the firms involved. Given this situation, we hypothesize the following:

Hypothesis 7. Technological turbulence strengthens both (a) the relationship of product innovation and market performance and (b) the relationship of process innovation and efficiency performance.

RESEARCH METHOD

Data Collection

To test the hypotheses, we collected data from Chinese small-and-medium-sized enterprises (SMEs) in the Chinese glass industry with fewer than 2,000 employees and less than 300 million Renminbi in sales revenue (National Bureau of Statistics, 2003). This industry was chosen because alliances are very common, and a high rate of innovation exists in the industry.

We conducted qualitative in-depth interviews with the executives of 20 companies in the industry. Based on the comments from these interviews, we revised a few items and finalized the questionnaire before conducting the formal survey. Because face-to-face interviews are considered a reliable means of collecting data in the emerging markets (Gu, Hung, & Tse, 2008), one of the authors, together with two trained post-graduate students, attended the China Glass 2009 exhibition in Shanghai, which is the largest annual event with highest attendance of glass manufacturers. Out of the 836 participating companies, 136 were from overseas or had foreign ownership. To discount the possibility of country-of-origin effect, we only targeted the remaining 700 Chinese firms in our data collection. We successfully interviewed 220 of them in a span of three days in mid-May 2009. This approach minimized early and late response biases. We then validated each completed questionnaire and followed up missing answers to the questionnaires through phone calls and e-mails to the firms concerned over a three-week period. Therefore, we had no missing values in the dataset. In summary, we achieved a response rate of 31% without missing values on any of the indicators of the constructs.

To test the nonresponse bias, we performed a profile comparison on the location, business type, firm age, and number of employees among the responding (220) and non-responding (480) Chinese firms that participated in the exhibition. The results of the analysis of variance showed no statistically significant differences between the two groups in terms of location, business type, and firm age (F=0.47, p=0.89, F=1.49, p=0.10, F=1.37, and p=2.33, respectively).

Next, we conducted an exploratory factor analysis (EFA), testing the measurement model by assessing the loadings and model fit. The EFA average factor loading was 0.67, which explained for 69% of the total variance, and had a coefficient alpha of 0.94. We used all the variables and 15 factors to set up the measurement models. The *F* statistic was 12.48 and was significant at $p<0.01$, with a mean of 4.1.

We conducted a confirmatory factor analysis, which included all theoretical constructs in our framework. The model achieved satisfactory model fit: χ^2/d.f.=1.97, CFI=0.83, IFI=0.83, RMSEA=0.07, and PNFI=0.64.

To assess the construct validity of the measurement model, we examined four important components of the construct validity, including the following: (1) convergent validity, (2) discriminant validity, (3) nomological validity, and (4) face validity (Hair Jr, Black, Babin, Anderson, & Tatham, 2006, pp. 776-779). We validated the face validity in the pilot study stage. We also assessed the correlations among constructs and confirmed the nomological validity (Hair Jr et al., 2006, p. 778). Majority of the standardized loadings of the indicators were above 0.70, and the average was 0.81. Majority of the average square factor loadings were above 0.50, and the average variance extracted (AVE) was 0.64. Majority of the Cronbach's alpha values were greater than 0.70, and the average was 0.79. Majority of the composite reliability values were also greater than 0.70, and the average was 0.87. These values demonstrated the convergent validity of our model. The measurement items and convergent validity assessment are included in Table 1.

("Table 1 goes about here")

To assess the discriminant validity, we compared the variance-extracted percentages for any two constructs (Hair Jr et al., 2006, p. 778). We found that the square root of the AVE was greater than all the inter-construct correlations, which provided evidence of sufficient discriminant validity (Chin, 1998). The discriminant validity test result is shown in Table 2.

("Table 2 goes about here")

Most researchers are faced with the potential problem of common-method variance (CMV) because the respondents answered the Likert-scale questionnaire based on their perceptions (Podsakoff, MacKenzie, Jeong-Yeon, & Podsakoff, 2003). To address this situation, we performed three remedial measures on the CMV, as suggested by Podsakoff et al. (2003). First, we performed the Harman's one-factor test similar to that of Li, Poppo, and Zhou (2008), although we recognize that this method is a very loose test (Podsakoff et al., 2003). The percentage variance extracted from the first unrotated factor was 23.23% compared with the total of 69.083%. Second, we followed the suggestions of Podsakoff et al. (2003) and Saraf, Langdon, and Gosain (2007) to test the Common Method Bias using SEM. We used AMOS 16 by adding a method factor with a path linked to each of the indicators of the substantive constructs. The results showed that none of the method factor loadings was significant. In addition, the indicators' substantive variances (square of factor loadings) were substantially greater than their method variances (6.2 times). Third, we performed the paired sample *t*-test and found that the means and variances of the employee size reported by the first and second informants did not exhibit any differences (p=0.18) with a t-value of 1.34. Based on the aforementioned analyses, we contended that the method bias is unlikely to be a serious concern in our study.

Measures

We developed the survey instrument from previous research and made appropriate modifications to suit the context of our study. We compiled most of the items from well-established measures in English. We then translated them into simplified Chinese characters. The questionnaire was translated back into English by a third party to ensure the equivalence of interpretations (Kotabe, Martin, & Domoto, 2003). Based on the immediate feedback from the pilot study, we concluded that the preliminary scales used were suitable for our purposes in this study. A five-point Likert scale was used throughout the study.

To measure the function, structure, and attribute domains suggested by Lavie and Rosenkopf (2006), we adapted the variables used by Rothaermel and Deeds (2004) and Varadarajan and Cunningham (1995). The function was measured for each type of alliance by items that focused on the firms' reasons for seeking an alliance, such as accomplishing long-term objectives or reducing the threat of competition. The structure was measured by such items as the desire to work with new partners or to work with partners with whom the firm had had a previous alliance. The attribute was measured by items that indicated the characteristics that a firm is looking for in an alliance partner, such as similarities or differences in size, capabilities, and organizational structure.

We adopted the measurements of product and process improvements used by Wolff and Pett (2004), He and Wong (2001), and Li and Atuahene-Gima (2007). Product innovation focuses on items that measured the introduction of leading ideas, new products, and enhanced brand identity. On the other hand, process innovation emphasizes on the adoption of the latest technology to improve existing product quality, improved flexibility, and yield in production and shortening of the production lead time.

We adopted the four measurement items of market performance used by Sarkar, Echambadi, and Harrison (2001a, pp. p.705-706), that is, market share, sales growth, market development, and product development. The respondents were asked to rate their performance relative to their competitors, with the anchors being “very superior” to “very inferior.” We adopted the efficiency-related performance measures from Isobe, Makino, and Montgomery (2008) and Bierly III and Daly (2007). We asked the respondents to rate their performance relative to their competitors using the same anchors as “very superior” to “very inferior.” In addition, we adopted the three items about process, quality, and lead time from Kotabe, Martin, and Domoto (2003) to measure the operational performance.

We adopted the measures of market turbulence, competitive intensity, and technological turbulence first used by Jaworski and Kohli (1993) and in other studies by, for example, Kandemir, Yaprak, and Cavusgil (2006), Hanvanich, Sivakumar, and Hult (2006), Sarkar, Echambadi, and Harrison (2001a), and Wu and Cavusgil (2006). To measure the market turbulence, the items concentrated on customer demands for new or different products. To measure the competitive intensity, we concentrated on the trade competition factors such as price and speed of reaction to changes to measure the technological turbulence. The items focused on rapid changes, opportunities provided, and possibility of new products being introduced.

In the present paper, we used as control variables the number of employees, research and development intensity, international sales intensity, sales, and firm's age (He & Wong, 2004; Lavie & Rosenkopf, 2006; Lu & Beamish, 2001; Singh, 1995).

RESULTS

The final structural model (Figure 2) contains the second-order explorative and exploitative alliance constructs and the control variables as mentioned in the last paragraph of the previous section. It also summarizes the hypothesis testing results, which we discuss below.

("Figure 2 goes about here")

The model has a GFI of 0.98, CFI and NFI of 0.96, IFI of 0.97, RMR of 0.01 and χ^2 of 26.24, with a degree of freedom of 4 at $p<0.01$.The model demonstrates good fits, with fit indexes larger than the 0.95 threshold. Moreover, our model demonstrates a reasonable level of factor loadings, as illustrated in Table 1.

In hypotheses H1a and H1b, we argued that both explorative and exploitative alliances were positively related to product innovation. The standardized regression weights of the explorative alliances to product innovation and the exploitative alliances to product innovation were 0.30*** and 0.22***, respectively, in the baseline model; therefore, H1a and H1b were supported. In H1c, we argued that the effect of the explorative alliances on product innovation was greater than that of the exploitative alliances on product innovation. We conducted the chi-square difference test to verify relative hypothesis H1c (Zhou, Yim, & Tse, 2005, p. 52). We compared the change in the chi square and the degree of freedom between the constrained and the unconstrained models using the baseline model. We set the path of H1a and H1b to have an equal regression weight. The change in the chi-square value was

144.59 and was significant at $\chi^2_{0.05}$. Therefore, we rejected the constrained model and allowed the paths free to estimate the path coefficients. The effect of the path coefficient of the explorative strategic alliance on product innovation at 0.30*** was greater than that of the exploitative strategic alliance at 0.22**; thus, H1c was supported.

In hypotheses H2a and H2b, we argued that both explorative and exploitative alliances were positively related to process innovation. The standardized regression weights of the explorative alliances to process innovation and the exploitative alliances to process innovation were 0.20* and 0.18*, respectively, in the baseline model. Therefore, H2a and H2b were supported. We performed the same chi-square difference test as that in H1c to verify relative hypothesis H2c. The change in the chi-square value was 161.72 and was significant at $\chi^2_{0.05}$. Therefore, we rejected the constrained model and allowed the paths free to estimate the path coefficients. Simultaneously, 0.20* was greater than 0.18*, and hypothesis H2c argued that the effect of the explorative strategic alliance on process innovation was greater than that of the exploitative strategic alliance and was therefore supported.

In H3, we argued that the effect of product innovation on the market performance was positive. The standardized regression weights of product innovation on the market performance were 0.22**; thus, H3 was supported.

In H4, we argued that the effect of process innovation on the efficiency performance was positive. The standardized regression weight of process innovation on the efficiency performance was 0.19*, and thus, H4 was supported. Moreover, we contended that product innovation was a mediator of market and efficiency performance with a standardized estimate of 0.22* and 0.30***, respectively, in the full model based on the path analysis (Calantone, Cavusgil, & Zhao, 2002). The relationships of the process innovation with the market performance and efficiency were significant at 0.23** and 0.19*, respectively. The Sobel test

(Preacher & Leonardelli, 2001) was conducted to assess the mediating effects of the product and process innovations. The results of the Sobel tests are demonstrated in Table 3.

("Table 3 goes about here")

In H5a, we argued that the effect of market turbulence on the relationship between the product innovation and market performance was positive. We also argued in H5b that the effect of market turbulence on the relationship between the process innovation and efficiency performance was negative. To test the moderation effects, we performed a multigroup analysis (Hanvanich et al., 2006, p. 606) by dividing the sample based on high and low turbulence. If the resulting regression weight estimates significantly differed between the two groups, we could conclude that a significant interaction existed (J. J. Li et al., 2008; Moorman & Miner, 1997). The high group had an estimate of 0.28*, and the low group had an insignificant estimate of 0.07. This evidence supported H5a. The market enhanced the effect of product innovation on the market performance under high turbulence. For H5b, the high group had an insignificant estimate of -0.05, and the low group had a significant estimate of 0.31***; therefore, H5b was also supported. The market enhanced the effect of process innovation on the efficiency performance under low turbulence. Furthermore, when the turbulence changed from low to high, the relationship between the process innovation and efficiency performance became insignificant.

In H6a, we argued that the effect of the competitive intensity on the relationship between the product innovation and market performance was positive. On the other hand, we argued in H6b that the effect of competitive intensity on the relationship between the process innovation and efficiency performance was negative. We performed the same multigroup analysis as that in H5a and H5b. For H6a, the estimate was significant at 0.37*** in the high group but insignificant at 0.07 in the low group; thus, the hypothesis was supported. Competition enhanced the positive relationship between the product innovation and market performance when its intensity was high. For H6b, the estimate was insignificant at 0.12 in the high group but significant at 0.23* in the low group; thus, H6b was also supported. Basically, competition enhanced the relationship between the process innovation and efficiency performance when its intensity was weak. When the competitive intensity increased, the effect of process innovation on the efficiency performance becomes insignificant.

In H7a and H7b, we argued that the effect of technological turbulence on the relationship between the product and process innovations and the market and efficiency performance, respectively, was positive. For H7a, the estimate was significant at 0.24* in the high group but insignificant at 0.14 in the low group; therefore, the hypothesis was supported. In short, technology enhanced the relationship between the product innovation and market performance when the turbulence was high. For H7b, the estimate was significant at 0.21* in the high group but insignificant at 0.19 in the low group; thus, the hypothesis was also supported. Technology also enhanced the relationship between the process innovation and efficiency performance when the turbulence was high. The summary of the hypothesis test results is provided in Table 4.

("Table 4 goes about here")

DISCUSSION AND CONCLUSION

We have found empirical support for all hypotheses in our research. First, we found that both explorative and exploitative alliances have a positive effect on the product and process innovations, but the explorative alliances outperformed the exploitative alliances in both product and process innovations. We thus posted a challenge to the claim of Grant and Baden-Fuller (2004, p. 77), who stated that the effect of exploitative alliances is stronger than that of explorative alliances.

With regard to the moderating role of the environmental factors, our study found that market turbulence is a positive moderator in the relationship between the product innovation and market performance but is a negative moderator in the relationship between the process innovation and efficiency performance. Competitive intensity is a positive moderator in the relationship between the product innovation and market performance but is a negative moderator in the relationship between the process innovation and efficiency performance. Technological turbulence is a positive moderator in the relationship between the product innovation and market performance and between the process innovation and efficiency performance. In general, we can argue that, in a high-turbulence environment, market turbulence, competitive intensity, and technological turbulence enhance the relationship between the product innovation and market performance. High technological turbulence has also a positive effect on the relationship between the process innovation and efficiency performance. The aforementioned findings are consistent with the findings in previous studies (H. Li & Atuahene-Gima, 2001; Sarkar et al., 2001a). Our findings also countered the unsupported arguments of Zhou (2006), who argued that market turbulence, competitive intensity, and technological turbulence weaken the relationship between the innovation and performance. We suggest that SME decision makers consider that the effect of external environment on the efficiency performance can be negative (except in the high-technological turbulence case) when they do not pursue product innovation.

Grant and Baden-Fuller (2004) argued that uncertainty about the future will discourage firms from forming alliances. This argument may be true in alliances that pursue process innovation alone because our findings showed that the moderating effect of high market turbulence and competitive intensity on the efficiency performance was negative when firms pursued process innovation. This situation may be explained by the fact that improving a process is useless if the product produced is no longer marketable. Only in periods of high technological turbulence that a positive effect on the efficiency performance was found in firms that pursued process innovation. This result suggests that only in such periods when alliances that pursue process innovation are likely to be successful. However, our findings suggest that environmental turbulence will have a positive effect on the market performance when firms pursue product innovation. The changing market demand appears to favor companies who bring out new products or improve existing ones. This finding suggests that firms who focus on product innovation will be in a strong position during times of environmental turbulence and may explain why firms who do not form alliances (and therefore do not invest in innovation) fail.

This study was aimed at discovering if product and process innovations are linked to market and efficiency performance. We have indeed shown a positive and significant relationship between the product innovation and both market and efficiency performance and a positive and significant relationship between the process innovation and the two performance types.

We found that explorative alliances have a greater effect on the performance than exploitative alliances through the introduction of more product and process innovation; however, explorative alliances have considerably higher associated costs. In addition to the larger financial outlay required, firms must consider the costs associated with requiring firms to go outside their core competences, with higher job stress and with employee turnover (Simpson, Siguaw, & Enz, 2006). Where the financial resources are severely limited, considering the formation of an explorative alliance may not be wise for decision makers; an exploitative alliance would be more suitable.

Decision makers must also take into account their firm's attitude to risk. An exploitative alliance has a far lower investment risk than an explorative alliance. Given that the chances of a new product being successful may only be 50%, as noted by Sivadas and Dwyer (2000), the money spent on product development could be wasted. A firm would be unwise to embark on forming an explorative alliance if it is not willing or able to take risks; an exploitative alliance would be a much safer undertaking.

Although this study has successfully contributed to both managerial theory and practice, two important shortfalls must be acknowledged. First, some variables other than the function, structure, and attribute domains may exist in the first-order level that need to be added to improve the explanatory power of the explorative and exploitative alliance constructs in the second-order level. Thus, room for future research may be available to enhance the operationalization of the explorative and exploitative alliances by, for example, introducing scope and depth as two explicit dimensions, as suggested by the research of Katila and Ahuja (2002).

Second, our focus was only on one industry: the glass industry. Although we included groups along the supply chain from the chosen industry and we feel comfortable in making inferences to similar industries such as those engaged in printing, electronics, and electrical goods manufacturing, generalizability to other industries such as high-technology- and service-based industries may be limited. Future research should seek survey responses from members of the Chinese SME Association located in various provinces and cities to understand the SME alliance activities across many industries and geographical areas so that the results can then be more widely generalized.

References

Ancona, D. G., Goodman, P. S., Lawrence, B. S., & Tushman, M. L. (2001). Time: A New Research Lens. *Academy Of Management Review, 26*(4), 645-563.

Atuahene-Gima, K., & Murray, J. Y. (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.

Bierly Iii, P. E., & Daly, P. S. (2007). Sources Of External Organisational Learning In Small Manufacturing Firms. *International Journal Of Technology Management, 38*(1/2), 45.

Brown, S. L., & Eisenhardt, K. M. (1995). Product Development: Past Research, Present Findings, And Future Directions. *Academy Of Management Review, 20*(2), 343-378.

Chin, W. W. (1998). Issues And Opinion On Structural Equation Modeling, *Mis Quarterly,* Pp. 1-1. Retrieved From Http://Search.Ebscohost.Com/Login.Aspx?Direct=True&Db=Bth&An=345479&Site=Ehost-Live

Combs, J. G., & Ketchen Jr, D. J. (1999). Explaining Interfirm Cooperation And Performance: Toward A Reconciliation Of Predictions From The Resource-Based View And Organizational Economics. *Strategic Management Journal, 20*(9), 867.

Emden, Z., Yaprak, A., & Cavusgil, S. T. (2005). Learning From Experience In International Alliances: Antecedents And Firm Performance Implications. *Journal Of Business Research, 58*(7), 883.

Grant, R. M., & Baden-Fuller, C. (2004). A Knowledge Accessing Theory Of Strategic Alliances. *Journal Of Management Studies, 41*(1).

Gu, F., Hung, K., & Tse, D. (2008). When Does Guanxi Matter? Issues Of Capitalization And Its Dark Sides. *Journal Of Marketing, 72*(4), 12.

Gulati, R. (1998). Alliances And Networks. *Strategic Management Journal, 19*(4), 293.

Gupta, A. K., Smith, K. G., & Shalley, C. E. (2006). The Interplay Between Exploration And Exploitation. *Academy Of Management Journal, 49*(4), 693-706.

Hair Jr, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate Data Analysis* (6th Ed. Ed.). Upper Saddle River, N.J. :: Pearson/Prentice Hall.

Hanvanich, S., Sivakumar, K., & Hult, G. T. M. (2006). The Relationship Of Learning And Memory With Organizational Performance: The Moderating Role Of Turbulence. *Academy Of Marketing Science. Journal, 34*(4), 600.

Hauser, J., Tellis, G. J., & Griffin, A. (2006). Research On Innovation: A Review And Agenda For Marketing Science. *Marketing Science, 25*(6), 687-717.

He, Z.-L., & Wong, P.-K. (2004). Exploration Vs. Exploitation: An Empirical Test Of The

Ambidexterity Hypothesis. *Organization Science, 15*(4), 481-494.

Hoang, H., & Rothaermel, F. T. (2005). The Effect Of General And Partner-Specific Alliance Experience On Joint R&D Project Performance. *Academy Of Management Journal, 48*(2), 332.

Isobe, T., Makino, S., & Montgomery, D. B. (2008). Technological Capabilities And Firm Performance: The Case Of Small Manufacturing Firms In Japan. *Asia Pacific Journal Of Management, 25*(3), 413-428.

Jaworski, B. J., & Kohli, A. K. (1993). Market Orientation: Antecedents And Consequences. *Journal Of Marketing, 57*(3), 53.

Kandemir, D., Yaprak, A., & Cavusgil, S. T. (2006). Alliance Orientation: Conceptualization, Measurement, And Impact On Market Performance. *Academy Of Marketing Science. Journal, 34*(3), 324.

Katila, R., & Ahuja, G. (2002). Something Old, Something New: A Longitudinal Study Of Search Behavior And New Product Introduction. *Academy Of Management Journal, 45*(6), 1183-1194.

Kotabe, M., Martin, X., & Domoto, H. (2003). Gaining From Vertical Partnerships: Knowledge Transfer, Relationship Duration, And Supplier Performance Improvement In The U.S. And Japanese Automotive Industries. *Strategic Management Journal, 24*(4), 293.

Koza, M. P., & Lewin, A. Y. (1998). The Co-Evolution Of Strategic Alliances. *Organization Science, 9*(3), 255-264.

Lavie, D., & Rosenkopf, L. (2006). Balancing Exploration And Exploitation In Alliance Formation. *Academy Of Management Journal, 49*(4), 797.

Levinthal, D. A., & March, J. G. (1993). The Myopia Of Learning. *Strategic Management Journal, 14*, 95.

Li, H., & Atuahene-Gima, K. (2001). Product Innovation Strategy And The Performance Of New Technology Ventures In China. *Academy Of Management Journal, 44*(6), 1123-1134.

Li, J. J., Poppo, L., & Zhou, K. Z. (2008). Do Managerial Ties In China Always Produce Value? Competition, Uncertainty, And Domestic Vs. Foreign Firms. *Strategic Management Journal, 29*(4), 383-400.

Lu, J. W., & Beamish, P. W. (2001). The Internationalization And Performance Of Smes. *Strategic Management Journal, 22*(6/7), 565.

March, J. G. (1991). Exploration And Exploitation In Organizational Learning *Organization Science, 2*(1), 71-87.

Mesquita, L. F., & Lazzarini, S. G. (2008). Horizontal And Vertical Relationships In Developing Economies: Implications For Smes' Access To Global Markets. *Academy Of Management Journal, 51*(2), 359-380.

Moorman, C., & Miner, A. S. (1997). The Impact Of Organizational Memory On New Product Performance And Creativity. *Journal Of Marketing Research (Jmr), 34*(1), 91-106.

Podsakoff, P. M., Mackenzie, S. B., Jeong-Yeon, L., & Podsakoff, N. P. (2003). Common Method Biases In Behavioral Research: A Critical Review Of The Literature And Recommended Remedies. *Journal Of Applied Psychology, 88*(5), 879.

Preacher, K. J., & Leonardelli, G. J. (2001). Calculation For The Sobel Test: An Interactive Calculation Tool For Mediation Tests, From Http://Www.People.Ku.Edu/~Preacher/Sobel/Sobel.Htm

Rothaermel, F. T. (2001a). Complementary Assets, Strategic Alliances, And The Incumbent's Advantage: An Empirical Study Of Industry And Firm Effects In The Biopharmaceutical Industry. *Research Policy, 30*(8), 1235.

Rothaermel, F. T. (2001b). Incumbent's Advantage Through Exploiting Complementary Assets Via Interfirm Cooperation. *Strategic Management Journal, 22*(6/7), 687.

Rothaermel, F. T., & Deeds, D. L. (2004). Exploration And Exploitation Alliances In Biotechnology: A System Of New Product Development. *Strategic Management Journal, 25*(3), 201-221.

Saraf, N., Langdon, C. S., & Gosain, S. (2007). Is Application Capabilities And Relational Value In Interfirm Partnerships. *Information Systems Research, 18*(3), 320-339.

Sarkar, M. B., Echambadi, R., & Harrison, J. S. (2001a). Alliance Entreprenuership And Firm Market Performance. *Strategic Management Journal, 22*(6/7), 701.

Sarkar, M. B., Echambadi, R. A. J., & Harrison, J. S. (2001b). Alliance Entrepreneurship And Firm Market Performance. *Strategic Management Journal, 22*(6/7), 701.

Sidhu, J. S., Commandeur, H. R., & Volberda, H. W. (2007). The Multifaceted Nature Of Exploration And Exploitation: Value Of Supply, Demand, And Spatial Search For Innovation. *Organization Science, 18*(1), 20-38.

Siguaw, J. A., Simpson, P. M., & Enz, C. A. (2006). Conceptualizing Innovation Orientation: A Framework For Study And Integration Of Innovation Research. *Journal Of Product Innovation Management, 23*(6), 556-574.

Simpson, P. M., Siguaw, J. A., & Enz, C. A. (2006). Innovation Orientation Outcomes: The Good And The Bad. *Journal Of Business Research, 59*(10/11), 1133-1141.

Singh, K. (1995). The Impact Of Technological Complexity And Interfirm Cooperation On Business Survival. *Academy Of Management Journal*, 67.

Sivadas, E., & Dwyer, F. R. (2000). An Examination Of Organizational Factors Influencing New Product Success In Internal And Alliance-Based Processes. *Journal Of Marketing, 64*(1), 31.

Vanhaverbeke, W., Duysters, G., & Noorderhaven, N. (2002). External Technology Sourcing Through Alliances Or Acquisitions: An Analysis Of The Application-Specific

Integrated Circuits Industry. *Organization Science, 13*(6), 714-733.

Varadarajan, P. R., & Cunningham, M. H. (1995). Strategic Alliances: A Synthesis Of Conceptual Foundations. *Academy Of Marketing Science. Journal, 23*(4), 282.

Wolff, J. A., & Pett, T. L. (2006). Small-Firm Performance: Modeling The Role Of Product And Process Improvements. *Journal Of Small Business Management, 44*(2), 268-284.

Wu, F., & Cavusgil, S. T. (2006). Organizational Learning, Commitment, And Joint Value Creation In Interfirm Relationships. *Journal Of Business Research, 59*(1), 81.

Yli-Renko, H., & Janakiraman, R. (2008). How Customer Portfolio Affects New Product Development In Technology-Based Entrepreneurial Firms? *Journal Of Marketing, 72*(5), 131-148.

Zhou, K. Z. (2006). Innovation, Imitation, And New Product Performance: The Case Of China. *Industrial Marketing Management, 35*(3), 394-402.

Zhou, K. Z., Yim, C. K., & Tse, D. K. (2005). The Effects Of Strategic Orientations On Technology- And Market-Based Breakthrough Innovations. *Journal Of Marketing, 69*(2), 42-60.

TABLE 1 **CONFIRMATORY FACTOR ANALYSIS FOR CONSTRUCT VALIDITY**

Constructs and Measures	**Validity**		
	α	**CR**	**AVE**
The following questions are about the objectives of strategic alliances and please answer according to your firm's situation but there is no right or wrong answer.			
Explorative Alliance	0.75	0.82	0.35
Explorative Alliance Function (SL=0.55)			
Explorative Alliance Structure (SL=0.88)			
Explorative Alliance Attribute (SL=0.72)			
Explorative Alliance Function	0.68	0.82	0.61
Accomplishing objectives that go beyond three years (SL=0.82)			
Upstream activities such as R&D (SL=0.88)			
Enabling our firm with new technology (SL=0.61)			
Explorative Alliance Structure	0.66	0.82	0.61
Working with new types of partners (SL=0.79)			
Working with firms which we have not tied with before (SL=0.84)			
Working with firms outside of our existing network (SL=0.70)			
Explorative Alliance Attribute	0.82	0.90	0.74
Our strategic alliances look for partner(s),			
who are different from our other partners by their organizational attributes e.g. size and capabilities (SL=0.82)			
who are different from our company in their organizational attributes e.g. size and capabilities (SL=0.89)			
who have different organizational culture (SL=0.88)			
Exploitative Alliance	0.82	0.86	0.42
Exploitative Alliance Function (SL=0.68)			
Exploitative Alliance Structure (SL=0.74)			
Exploitative Alliance Attribute (SL=0.75)			
Exploitative Alliance Function	0.71	0.84	0.63
Reducing the threat of new competition (SL=0.82)			
Erecting barriers to retard new competition (SL=0.85)			
Entering new market for our existing products (SL=0.71)			
Exploitative Alliance Structure	0.78	0.87	0.69
Working with type(s) of partner(s) that we have been familiar with (SL=0.86)			
Working with firm(s) that we have alliance experience (SL=0.85)			
Working with firm(s) in our existing network (SL=0.79)			
Exploitative Alliance Attribute	0.83	0.90	0.75
Our strategic alliances look for partner(s),			
that is same as our other partners in their organizational attributes such as size and capabilities (SL=0.88)			
that is same as our company in their organizational attributes such as size and capabilities (SL=0.89)			
with compatible culture (SL=0.83)			

Following questions are describing your firm's innovation in past year:			
Product Innovation	0.85	0.90	0.69
We have produced some leading ideas in the industry (SL=0.85)			
We have created a distinct image of our product line (SL=0.85)			
We have developed some new products (SL=0.83)			
We have enhanced the brand identity (SL=0.79)			
Process Innovation	0.86	0.91	0.71
We have adopted the latest technology for improving existing product quality (SL=0.84)			
We have adopted the latest technology for improving flexibility in production (SL=0.86)			
We have adopted the latest technology for improving yield in production (SL=0.85)			
We have adopted latest technology for shortening the production lead-time (SL=0.81)			
Please evaluate your firm performance relative to your major competitors in the past year.			
Market Performance	0.81	0.88	0.64
Sales growth rate (SL=0.80)			
Market share of our products (SL=0.84)			
Price premiums charged for our products (SL=0.81)			
Price competitiveness of our products (SL=0.76)			
Efficiency Performance	0.86	0.91	0.71
Production efficiency (SL=0.83)			
Production / Delivery Lead-time (SL=0.87)			
Sales and marketing process efficiency (SL=0.83)			
Overall process design (SL=0.83)			
Please evaluate about your industry.			
Market Turbulence	0.82	0.90	0.75
Customers frequently change their product preference (SL=0.87)			
Our customers are looking for new products all the time (SL=0.89)			
We have demand for new products and services (SL=0.83)			
Technology Turbulence	0.81	0.90	0.69
The technology is changing rapidly (SL=0.90)			
Technological changes provide big opportunities (SL=0.78)			
New products have been made possible through technological breakthroughs (SL=0.80)			
Competitive Intensity	0.77	0.83	0.62
Competition is severe such as price (SL=0.62)			
Competitors can match us quickly (SL=0.77)			
Our competitors are relatively strong (SL=0.94)			
Average (SL=0.81)	0.79	0.87	0.64

Note: α= Cronbach's α, CR= Composite Reliability, SL=Standardized Loading

TABLE 2 Discriminant Validity Test: AVE and Inter-construct Correlations

Variable	Mean	S.D.	AVE	SQRT AVE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Explorative Function	4.28	0.58	0.61	0.78	1.000														
Explorative Structure	3.99	0.59	0.61	0.78	.265**	1.000													
Explorative Attributes	3.82	0.70	0.74	0.86	.068	.506**	1.000												
Exploitative Function	4.03	0.62	0.63	0.79	.220**	.227**	.286**	1.000											
Exploitative Structure	4.13	0.53	0.69	0.83	.129	.420**	.330**	.337**	1.000										
Exploitative Attributes	3.90	0.65	0.75	0.87	.187**	.387**	.419**	.441**	.429**	1.000									
Explorative Alliance	4.03	0.449	0.35	0.59	.487**	.842**	.812**	.335**	.424**	.474**	1.000								
Exploitative Alliance	4.02	0.465	0.42	0.65	.228**	.452**	.450**	.730**	.765**	.828**	.536**	1.000							
Product innovation	4.14	0.604	0.69	0.83	.386**	.314**	.312**	.310**	.429**	.274**	.443**	.433**	1.000						
Process innovation	4.09	0.596	0.71	0.84	.353*	.210**	.190**	.206**	.310**	.243**	.316**	.328**	.632**	1.000					
Market performance	3.99	0.533	0.64	0.80	.228**	.340**	.252**	.306**	.292**	.361**	.374**	.412**	.381**	.379**	1.000				
Efficiency performance	4.06	0.570	0.71	0.84	.316**	.255**	.217**	.230**	.282**	.287**	.341**	.346**	.439**	.387**	.570**	1.000			
Market turbulence	4.10	0.662	0.75	0.87	.151*	.259**	.271**	.091	.158*	.226**	.320**	.210**	.340**	.250**	.296**	.249**	1.000		
Technology turbulence	4.18	0.595	0.69	0.83	.189**	.156*	.175**	.059	.112	.223**	.230**	.177**	.345**	.290**	.213**	.108**	.525**	1.000	
Competitive Intensity	4.02	0.617	0.62	0.79	.058	.237**	.274**	.193**	.214**	.214**	.282**	.267**	.197**	.250**	.324**	.126	.292**	.273**	1.000
Average AVE			0.64																

*p< 0.05, **p<0.01 Notes: S.D. = standard deviation, AVE= average variance explained, SQRT= square root

TABLE 3 Results of Sobel Tests

MEDIATORS	EFFECTS	SOBEL TEST STATISTICS	P-VALUE
PDI	RSA → MP	3.057**	< 0.01
	RSA → EP	3.810***	< 0.001
	TSA → MP	2.956**	< 0.01
	TSA → EP	3.750***	< 0.001
PCI	RSA → MP	2.983**	< 0.01
	RSA → EP	3.081**	< 0.01
	TSA → MP	2.905**	< 0.01
	TSA → EP	3.036**	< 0.01

***: P < 0.001; **: P < 0.01; *: P < 0.05

Notes: RSA= explorative alliance, TSA= exploitative alliance, PDI= product innovation, PCI=process innovation, MP= market performance, EP= efficiency performance

TABLE 4 Hypothesis Test Results

Hypotheses	Paths	Standardized Regression Weights	Results	Remarks
H1a	RSA to PDI is positive	0.30*** (4.39)	Supported	Goodness of fit: $\chi^2 = 26.24$; d.f. = 4; GFI = 0.98; CFI = 0.96; NFI = 0.96; RMR = 0.01
H1b	TSA to PDI is positive	0.22** (3.23)	Supported	
H2a	RSA to PCI is positive	0.20* (2.64)	Supported	
H2b	TSA to PCI is positive	0.18* (2.64)	Supported	
H1c	H1a>H1b	0.30*** > 0.22**	Supported	Baseline: (χ^2 = 170.79, d.f. = 6); $\Delta\chi^2$ = 144.59, significant at $\chi^2_{.05}$
H2c	H2a>H2b	0.20* > 0.18*	Supported	Baseline: (χ^2 = 187.92, d.f. = 6); $\Delta\chi^2$ = 161.72, significant at $\chi^2_{.05}$
H3	PDI on MP is positive	MP = 0.22** (2.69)	Supported	
H4	PCI on EP is positive	EP = 0.19* (2.41)	Supported	
H5a	MT on PDI to MP is positive	High group 0.28*, Low group 0.07 insignificant	Supported	
H5b	MT on PCI to EP is negative	High group 0.05 insignificant, Low group 0.31***	Supported	
H6a	CI on PDI to MP is positive	High group 0.37***, Low group 0.07 insignificant	Supported	
H6b	CI on PCI to EP is negative	High group 0.12 insignificant, Low group 0.23*	Supported	
H7a	TT on PDI to MP is positive	High group 0.24*, Low group 0.14 insignificant	Supported	
H7b	TT on PCI to EP is positive	High group 021*, Low group 0.19 insignificant	Supported	

***p< 0.001, ** p<0.01, *p<0.05

Notes: RSA= explorative alliance, TSA= exploitative alliance, PDI= product innovation, PCI=process innovation, MP= market performance, EP= efficiency performance, MT=market turbulence, TT=technology turbulence, CI= competitive intensity

Figure 1 Conceptual Model

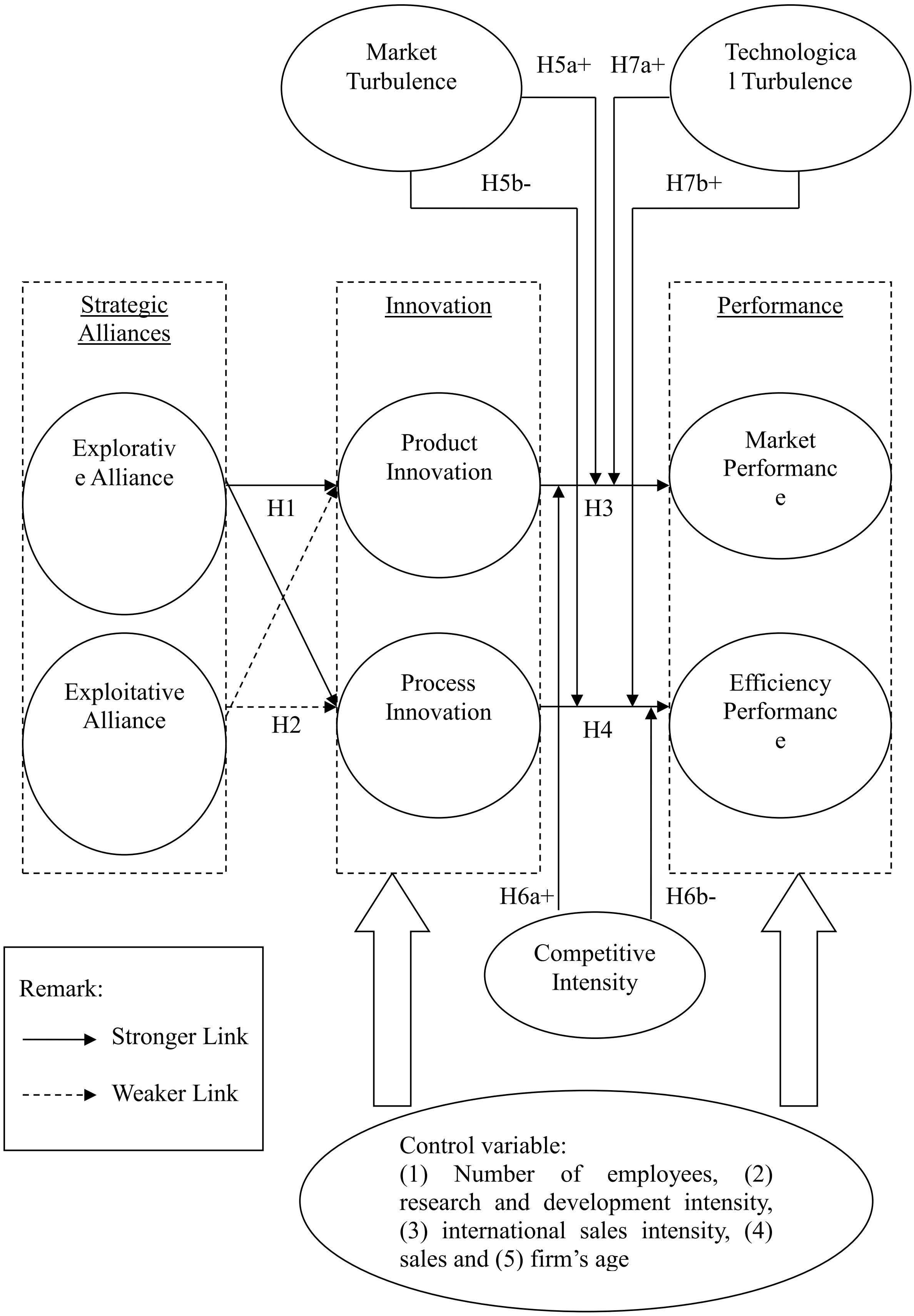
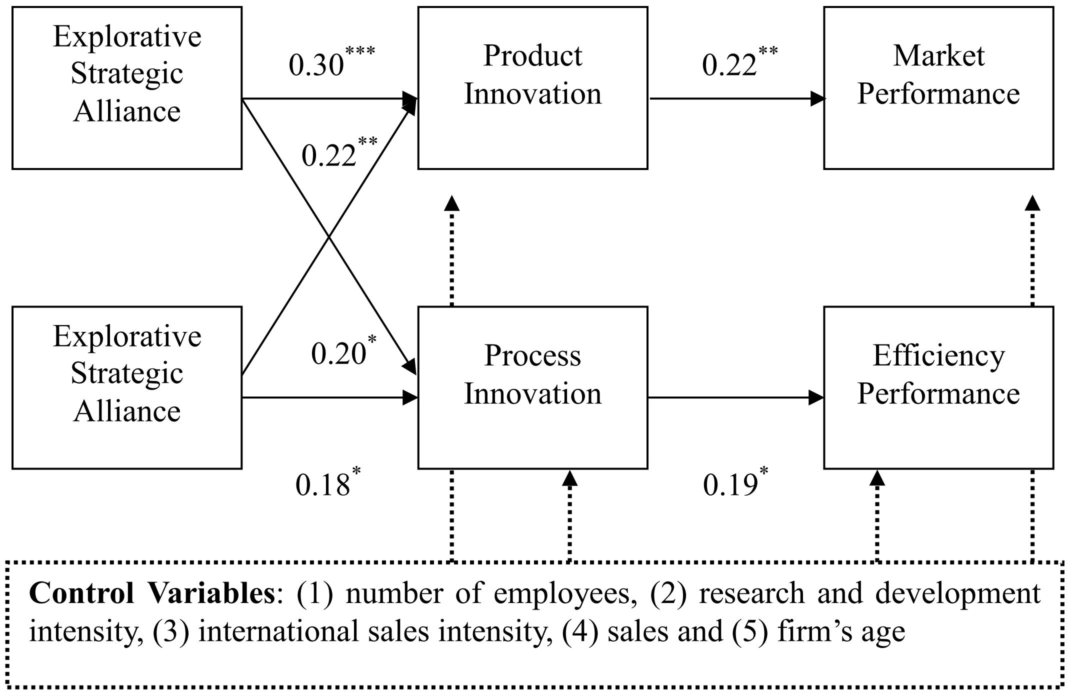


Figure 2 Structural Model



***$p < 0.001$, ** $p<0.01$, *$p<0.05$

Note:

1. RSA=explorative strategic alliance, TSA=exploitative strategic alliance, TSA=exploitative strategic alliance, PDI= product innovation, PCI= process innovation, MP= market performance, EP= efficiency performance, MT=market turbulence, TT=technology turbulence, CI=competitive intensity