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Customer involvement and new product performance: The jointly moderating effects of technological and market newness

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Abstract
Purpose – The purpose of this paper is to examine the joint influence of technological newness (TN) and market newness (MN) on the relationship between customer involvement (CI) and new product performance.
Design/methodology/approach – The authors employed hierarchical moderated regression analysis to test the hypothesized relationships using survey data collected from 214 Chinese manufacturing firms.
Findings – The authors found that the impact of CI on new product performance varies across the different configurations of TN and MN. Specifically, the performance effect of CI is most positive under low TN and high MN, while the performance effect is least positive under low TN and low MN.
Originality/value – This study enriches CI research by identifying different configurations of product innovativeness that augment or limit the value of CI.
Keywords New product performance, Customer involvement, Configurational approach, Market newness, Technological newness
Paper type Research paper

1. Introduction
Taking advantage of external knowledge is increasingly important for developing successful new products (Chao-Ton *et al.*, 2006; Feng and Wang, 2013; Peng *et al.*, 2014). Researchers as well as practitioners have considered customers as a critical source of external knowledge and asked for more involvement of customers into new product development (NPD) (Feng *et al.*, 2010; Menguc *et al.*, 2014; Mishra and Shah, 2009). A firm can acquire core resources and knowledge by involving its major customer into the product development process (Feng *et al.*, 2010). However, existing findings are not consistent in the relationship between customer involvement (CI) and new product performance (Feng and Wang, 2013; Lau, 2011; Mishra and Shah, 2009). The absence of evidence calls for further research into contextual factors that may explain the

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inconsistent findings. In other words, it is critical to understand whether the relationship between CI and new product performance depends on particular contingencies.

Since the opportunities and constraints of implementing CI are greatly determined by product innovativeness (Lau, 2011), we suggest that product innovativeness needs to be taken into account when explaining the CI-new product performance relationship. Moreover, the successful transformation of CI into improved new product performance depends upon adjusting the level of CI according to the degree of product innovativeness (Salomo *et al.*, 2003). To clarify the nature of the CI-new product performance relationship, this study adopted contingency theory and the interactional perspective. According to contingency theory, researchers should pay more attention to the potential influence of contingency factors when examining the performance effect of CI (Hatch and Cunliffe, 2006). In addition, the interactional perspective indicates that different situational factors should be considered concurrently when explaining how organizational behaviors affect organizational performance (Kim and Yun, 2015; Pfeffer, 1997). Drawing upon contingency theory and the interactional perspective, we suggest that product innovativeness may moderate the relationship between CI and new product performance. This issue is important but remains mostly neglected in the existing CI literature.

The degree to which a firm faces an unfamiliar technological and/or market environment influences the level of product innovativeness (Hult *et al.*, 2004). Thus, it is important to consider product innovativeness from both technological and marketing perspectives (Calantone *et al.*, 2006; Lau, 2011). In this study, we divided product innovativeness into two dimensions: technological newness (TN) and market newness (MN). The strategic fit perspective suggests that the fit between a firm's strategic choice and the requirements of NPD is crucial to achieve superior performance (Olson *et al.*, 1995; Prajogo, 2016). Thus, TN and MN may be important factors influencing the relationship between CI and new product performance.

Furthermore, it is likely to be inappropriate to isolate the moderating effects of TN and MN when examining the performance effect of CI. Because TN and MN are two facets of product innovativeness, and they often coexist for a new product (Lau, 2011; Tsai *et al.*, 2015), it is necessary to simultaneously consider the separate and joint moderating effects of TN and MN. In addition, Lumpkin and Dess (2001) argued that the moderating effect of environmental hostility on the entrepreneurial orientation-performance relationship may be influenced by other situational factors. Similarly, the moderating effect of TN may be affected by other factors such as MN because firms have to introduce the new product into market. Thus, investigating the combined moderating roles of TN and MN may extend our understanding of when CI impacts new product performance and may offer rich and useful implication to practitioners. To the best of our knowledge, few studies have examined how these two dimensions of product innovativeness jointly influence the CI-new product performance relationship.

To fill these research gaps and gain new insights into the relationship between CI and new product performance, we address two important questions: how TN and MN separately moderate the relationship between CI and new product performance; and how TN and MN jointly moderate the relationship between CI and new product performance. The purpose of this research is to examine whether and how the performance effect of CI depend on TN, MN and/or their combination. This study contributes to the CI literature by clarifying the configurations of two dimensions of product innovativeness that influence the relationship between CI and new product performance. The findings of our research highlight that the effect of CI on new product performance varies according to the combined influence of TN and MN. Thus, this research provides insightful implications for theory and practice.

2. Literature review

2.1 CI

CI is defined as the degree to which customers are involved in a firm's NPD and continuous improvement programs (Feng *et al.*, 2014). CI may range from providing minor design suggestions to being responsible for the whole development process of a new product (Chen and Paulraj, 2004). Since customers can be involved not only in market opportunity analysis but also in product testing, product commercialization and continuous improvement, CI has been considered as one of the most often used methods to improve new product performance (Feng *et al.*, 2014).

The important roles of CI have been widely investigated in the existing literature. However, previous findings on the relationship between CI and new product performance are inconsistent. Some studies indicated that CI enhances new product performance by understanding customer needs better, providing innovative ideas, improving product quality and reducing development time (e.g. Carbonell *et al.*, 2009; Feng and Wang, 2013; Gruner and Homburg, 2000; Johnson and Luo, 2008; Lau, 2011), while others reported a non-significant or even negative impact of CI on new product performance (e.g. Campbell and Cooper, 1999; Fang, 2008; Mishra and Shah, 2009). The inconsistent findings call for further research into contingency factors that may explain under what conditions CI improves new product performance.

2.2 Product innovativeness

Although existing literature proposed a variety of definitions for product innovativeness, consensus has not been made (Calantone *et al.*, 2006; Lau, 2011; Szymanski *et al.*, 2007). After comprehensively reviewing literature, Garcia and Calantone (2002) suggested that it is important to consider product innovativeness from both technological and marketing perspectives. In this study, product innovativeness is defined as the extent to which a firm's new product requires unfamiliar technological and/or marketing resources and capabilities based on resource-based view (RBV) and organizational learning theory (Molina-Castillo and Munuera-Aleman, 2009; Song and Parry, 1997). Product innovativeness will be high when a new product of a firm requires a great number of unfamiliar technological and/or marketing resources and capabilities.

The direct impact of product innovativeness on new product performance has been extensively studied. For example, Lau (2011) found that product innovativeness has a positive impact on new product performance because a new product with a different level of innovativeness will express different requirements. Recently, Story *et al.* (2015) found that there is an inverted U-shaped relationship between product innovativeness and new product performance. However, product innovativeness may influence new product performance indirectly (Millson, 2013). From a perspective of strategic fit, as the strategic choice of a firm CI should fit with the requirements of NPD to enhance new product performance (Olson *et al.*, 1995; Prajogo, 2016). Thus, we expect that product innovativeness may influence the relationship between CI and new product performance.

3. Hypothesis development

In this study, we combine RBV with contingency theory to propose that there is a relationship between CI, new product performance and product innovativeness.

According to RBV (Barney, 1991), how to leverage resources owned by internal functions and external partners influences a firm's success (Lau *et al.*, 2010). In the framework of RBV, a firm is deemed as a bundle of resources (Wernerfelt, 1984). Long-term competitive advantage can be achieved if a firm possesses valuable, rare, inimitable and non-substitutable resource (Barney, 1991). The RBV argues that firm resources include tangible resources (e.g. products, equipment and employees) and intangible resources (e.g. corporate culture, reputation and relationship with customers) (Barney, 1991), as well as internal resources (e.g. employee skills and raw materials) and external resources (e.g. market response and relationship management) (Wade and Hulland, 2004; Lau *et al.*, 2010). Lau *et al.* (2010) proposed that external integrative capability is one kind of external resources. Thus, CI can help firms to gain valuable and inimitable resources required for developing new products. Several recent studies have considered CI as important sources of resources and capabilities for a firm to improve its new product performance (Feng and Wang, 2013; Lau, 2011).

Existing literature often employs contingency theory to explain organizational issues from a contextual perspective (Jayaram *et al.*, 2011). Contingency theory suggests that organizational performance depends on its ability to adjust or adapt to the environment, and that there is a need for match between an organization and its environment, strategy and structure (Drazin and van de Ven, 1985). Following contingency theory, this study addresses that CI and product innovativeness should be matched to achieve the improved new product performance. Figure 1 depicts the conceptual model, which highlights the moderating effects of TN, MN and their combination on the relationship between CI and new product performance. Figure 1 also presents the research hypotheses that are developed in this study.

3.1 CI and new product performance

RBV suggests that a firm needs to involve customers into its product development process in order to use customers' resources and capabilities to enhance product development performance (Feng and Wang, 2013; Mishra and Shah, 2009). Thus, CI can be deemed as a source of competitive advantage by providing resources and information required by NPD (Feng *et al.*, 2010, 2014). Involving customers into the product development process allows customer preferences and needs to be captured and facilitates the creation of effective customer-oriented products (Wang *et al.*, 2016) which may enhance new product performance (Lau *et al.*, 2010). A better understanding of customer needs provides a firm with opportunities to acquire distinctive resources and information that can lead to superior performance. On the contrary, failure to consider customer preferences and needs in the product development process often leads to various glitches and even new product failure (Menguc *et al.*, 2014).

In addition, CI helps identify design problems early, select ideas effectively, reduce design changes in later stages of the product development process and provide

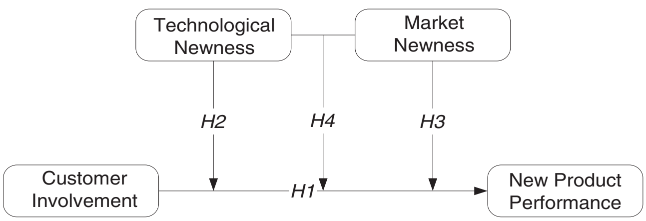

Figure 1.
Conceptual model

innovative ideas (Lau, 2011). This improves NPD speed (Feng and Wang, 2013), manufacturing agility (Feng *et al.*, 2010) and customer satisfaction (Tan and Tracey, 2007). Thus a higher degree of CI will result in more timely and relevant customer resources and information. Firms can use these resources and information to create innovation and marketing differentiation, which can lead to enhanced new product performance (Lau, 2011). Therefore, we propose the following hypothesis:

H1. There is a positive relationship between CI and new product performance.

3.2 The moderating effect of TN

In this study, we define TN on the basis of degree of familiarity with the given technology. Thus, TN refers to the newness to the firm of the technologies employed in the product development effort. For a technologically new product, the firm does not fully understand the new technology, know the specific means designing the product, or is unsure about business results (Tatikonda and Rosenthal, 2000). Furthermore, RBV suggests that TN describes the degree of fit between the requirements of a new product and a firm's existing technological resources and capabilities (Molina-Castillo and Munuera-Aleman, 2009). TN will be high when there is a low fit between the requirements of a new product and the technological resources and capabilities of a firm.

It is argued that increased TN increases the need for gaining resources and capabilities from outside of the firm. When developing new products with high TN, because firms have fewer relevant resources and capabilities to draw upon, they perceive these projects to be more challenging and depend more heavily on their partners for the resources and information needed to develop a successful product (Tatikonda and Rosenthal, 2000). However, customers contribute to product development mainly by providing knowledge and information in demands and preferences (Feng and Wang, 2013). They may have difficulty in providing useful inputs related to technology and may not know what the exact requirements are of technologically new products (Carbonell *et al.*, 2004; Narver *et al.* 2004). Thus, the roles in providing needed resources and information played by customers may be reduced for technologically new products.

In addition, some customers are resistant to technologically new products and failed to understand the new products (Heiskanen *et al.*, 2007). If firms involve these customers into NPD projects with high TN, they may get into irrational thinking, which may impair new product performance. Thus, TN is likely to weaken the contribution of CI to new product performance. Taken together, we hypothesize:

H2. TN negatively moderates the relationship between CI and new product performance.

3.3 The moderating effect of MN

MN is another important factor influencing the performance effect of CI, which reflects the newness to the firm of the market which the new product is going to enter. Improved MN features higher degree of misfit between the requirements of a new product and a firm's existing market resources and capabilities (Molina-Castillo and Munuera-Aleman, 2009). When MN is lower, firms can operate using their existing resources and knowledge. However, as the level of MN increases, firms will adapt their operation strategies accordingly. When MN is high, firms will need to undertake proactive activities, such as looking for new ways or sources to gain resources and information required by product development.

We assume that MN may also moderate the relationship between CI and new product performance for two major reasons. First, information processing theory suggests that firms implementing CI are in a favorable position since they can rapidly acquire and interpret a wide range of customer information and utilize the information to develop new products (Lundkvist and Yakhlef, 2004). With the increasing of MN, the need to gather and analyze customer information will be reinforced. Hence, increased newness in markets may place a premium on CI. Second, information and knowledge from customers are likely to mitigate the potential threat of MN. It is difficult to accurately predict products with high MN because they do not yet exist in the existing market (Veldhuizen *et al.*, 2006). Firms involving customers into product development process can acquire market resources and information, which help them enhance the ability dealing with uncertainties caused by MN. CI also facilitates the process of communication and feedback (Feng and Wang, 2013). Therefore, firms implementing CI often have more efficient ways of developing new products. When the market being entered is one that is familiar to the firm, CI should be less important. As the level of MN increases, the importance of CI should also increase. Thus, we propose the following hypothesis:

H3. MN positively moderates the relationship between CI and new product performance.

3.4 The joint moderating effects of TN and MN

In addition to their independent moderating effects, TN and MN may jointly moderate the relationship between CI and new product performance. Since TN and MN are two dimensions of product innovativeness and may act together (Calantone *et al.*, 2006; Lau, 2011), these two factors are likely to have a synergistic moderating effect on the relationship between CI and new product performance. We thus speculate that TN and MN may interactively affect the impact of CI on new product performance. In other words, the moderating effect of individual dimensions of product innovativeness is likely to depend upon the level of the other.

Furthermore, isolating the effects of each contingent factor may underestimate the complex forms of interaction and may thus oversimplify the actual conditions under which CI influences new product performance (Tsai and Yang, 2013). In contrast, considering TN and MN simultaneously may give rise to a more theoretically interesting and interpretable pattern than separating the factors (Rousseau and Fried, 2001). Suggested by previous literature (Dess, *et al.*, 1997; Tsai and Yang, 2013; Wiklund and Shepherd, 2005), we employ a configuration approach to examine how TN and MN jointly influence the relationship between CI and new product performance. From the perspective of configuration approach, the combination of TN and MN will form a set of configurations according to their levels and that these different configurations may have distinct influences on the performance effects of CI. Since the four different configurations (i.e. low and high levels of TN and MN) may generate different opportunities, constraints and challenges in product development, the strength of the relationship between CI and new product performance may vary across these configurations. At one extreme, under the configuration of low TN and high MN, firms should gain the most benefit by implementing CI. If the product development needs information related to customer preferences but does not need customers provide technology knowledge, firms are most likely to realize the maximum value of their CI implementation because they can better take advantage of resources and information possessed by customers.

At the opposite extreme, under the configuration of high TN and low MN, the effect of CI on new product performance may become slight. When a firm does not understand the technology and familiar with the market being entered, implementing CI may improve its performance but only to a lesser degree. Therefore, it may be less effective for a firm to implement CI under such situations. Situated between these two extremes, the remaining two configurations (i.e. low TN with low MN and high TN with high MN) may have an intermediate effect on the strength of the relationship between CI and new product performance. However, few studies have examined which of these two factors has a stronger effect on the effectiveness of CI. In this study, we conjecture that CI may improve new product performance to a larger degree under the configuration of low TN and high MN than under other three configurations. Thus, we hypothesize:

H4 . TN and MN have a negative joint moderating effect on the relationship between CI and new product performance.

4. Research method

4.1 Sampling and data collection

Because China is a large country with economic development varying across different areas, five regions were strategically selected to provide economic and geographic diversity. Shaanxi, located in the northwest, represents a relatively low level of economic development. Shandong and Beijing represent the Bohai Sea coastal region and reflect the average level of economic development. Jiangsu and Guangdong represent the Yangtze River Delta and the Pearl River Delta, respectively, and both enjoy the highest degree of marketization and economic reform.

To obtain representative samples, firms from the government directories of firms in the manufacturing sector were randomly selected. These firms were contacted to identify key informants, who usually have a title such as CEO/president, vice president or manager in charge of marketing and R&D. We sent the questionnaire together with a covering letter explaining our research objectives and ensuring confidentiality to the key informant. As an incentive, a summary report of the survey results would be available to respondents. To improve the response rate, both follow-up calls and mailings were made.

We started the survey in August 2010 and 226 firms returned the questionnaire by March 2011. Out of the 226 responses received, 12 are deleted because of missing data. Thus, 214 firms are usable which results an effective response rate of 28.53 percent (214/750). Profiles of the responding firms are depicted in Table I. The responding firms represent a variety of industries and their distribution is representative of the concentration of industries in the regions studied. Most of the informants have been in their current positions for more than three years, suggesting they are knowledgeable about the information requested.

To check the potential non-response bias, firm size, firm age and ownership type between the responding and non-responding firms were compared using *t*-tests or χ^2 tests. The insignificant statistics indicate that non-response bias is not serious. Furthermore, the sample was split into two groups based on the time they returned the questionnaire. We then compared the early and late responses to all variables using *t*-tests (Armstrong and Overton, 1977). No significant differences were found, which further suggests that non-response bias is not an issue.

4.2 Questionnaire design

Our measurement items were mainly drawn from previous studies. The measures for CI were adapted from Mishra and Shah (2009) and Feng *et al.* (2010). The scales for TN

	Total	Shandong	Shaanxi	Beijing	Guangdong	Jiangsu
Sample size	214	53	50	39	38	34
Industry (%)						
Food and beverage	2.80	0.00	6.00	2.56	0.00	5.88
Textile and apparel	3.27	0.00	2.00	5.13	5.26	5.88
Paper and printing	1.40	0.00	2.00	2.56	0.00	2.94
Chemicals and petrochemicals	5.14	9.43	4.00	5.13	5.26	0.00
Rubber and plastics	1.40	3.77	0.00	0.00	2.63	0.00
Non-metallic mineral products	6.54	13.21	4.00	5.13	2.63	5.88
Smelting and pressing	5.14	15.09	4.00	0.00	2.63	0.00
Metal products	9.81	16.98	10.00	2.56	2.63	14.71
Mechanical and engineering	19.16	13.21	34.00	10.26	10.53	26.47
Electronics and electrical	25.70	16.98	20.00	28.46	34.21	23.53
Instruments and related products	12.15	5.67	10.00	12.82	21.05	14.71
Others	7.48	5.67	4.00	15.38	13.16	0.00
Number of employees (%)						
Less than 50	11.68	1.89	18.00	20.51	7.89	11.76
50-99	18.69	26.42	12.00	17.95	23.68	11.76
100-299	27.10	41.51	24.00	23.08	26.32	14.71
300-999	18.69	20.75	10.00	17.95	21.05	26.47
1,000-1,999	9.35	1.89	16.00	2.56	10.53	17.65
2,000-4,999	8.88	3.77	14.00	7.69	5.26	14.71
No less than 5,000	5.61	3.77	6.00	10.26	5.26	2.94

Table I. Profiles of responding firms

and MN were selected from those used by Molina-Castillo and Munuera-Aleman (2009). The measures for new product performance were adopted from Wagner (2010). The items used to operationalize the constructs employing a seven-point Likert scale are depicted in the Appendix.

Since the measures drawn from the literature were in English, an English version of the questionnaire was first developed, and subsequently translated into Chinese. It was then translated back into English. This back-translation version was checked against the original English version to ensure accuracy. In the survey, the Chinese version was used. Before launching the survey, three academicians and five managers reviewed the questionnaire and their feedback was incorporated in the final questionnaire. The questionnaire was then pilot tested using a sample of eight companies. Based on their feedback, additional modifications and clarifications were made to ensure it was more understandable and relevant to practices in China.

Since there was a single respondent for each firm, the potential for common method variance (CMV) was assessed. To evaluate CMV, we strategically selected two informants in each of the ten responding firms and then interviewed them separately using the same questionnaire. For convenience, these ten firms were chosen based on their geographic proximity to our university. The reliability test indicated that the level of internal consistency between two sets of answers was high. Harman's one-factor test was used to test common method bias (Podsakoff *et al.*, 2003) and four distinct factors were found, revealing that common method bias was not an issue in our research. To further assess common method bias, a measurement model including only the traits and one including a method factor in addition to the traits were compared (Cote and Buckley, 1987). The results indicated that the model including a method factor marginally improves the model fit indices (NNFI by 0.02 and CFI 0.01), with the common method factor accounting for 10.6 percent of the total variance. Furthermore, the factor loadings are still significant after including a method factor, demonstrating that the model was robust (Flynn *et al.*, 2010). Thus, it is reasonable to conclude that common method bias is not a problem.

4.3 Reliability and validity

This study used a rigorous process to develop and validate the instrument. Before collecting data, content validity was ensured by existing literature, executive interviews and pilot tests. After data collection, several analyses were conducted to test the reliability and validity of the constructs.

4.3.1 Reliability. We first conducted exploratory factor analysis using SPSS 22 to ensure unidimensionality of the scales (Narasimhan and Jayaram, 1998). Four factors with eigenvalues above 1.0 emerged, explaining 83.7 percent of the total variance. In addition, all items had strong factor loadings on the constructs they were supposed to measure and had lower factor loadings on the constructs they were not supposed to measure. Thus, the results demonstrate construct unidimensionality.

Cronbach's α was then calculated for each construct to test internal consistency. The generally accepted threshold value for Cronbach's α is 0.70 (Fornell and Larcker, 1981). The Cronbach's α values of constructs were all above the cutoff point. To assess construct reliability, composite reliability (CR) was also calculated (Fornell and Larcker, 1981). All CR values were greater than 0.90, which is higher than the minimum agreed value of 0.60. Both the Cronbach's α values and the CR values suggested that the scales are reliable (Table II).

4.3.2 Construct validity. Confirmatory factor analysis (CFA) was used to assess convergent and discriminant validity. To assess convergent validity, a CFA model was constructed in which each item was linked to its intended construct, and the covariances among these constructs were freely estimated using the maximum likelihood estimation method in LISREL 8.8. This is because LISREL uses correlations and covariances of error terms as two independent sources of information, which depicts the data variation more

Table II. Statistics of the measurement analysis

Constructs	Scale items	Standardized factor loadings	CITC range of the underlying items	Cronbach's α	Composite reliability
Customer involvement	CI1	0.87	0.822	0.938	0.911
	CI2	0.91	0.874		
	CI3	0.85	0.821		
	CI4	0.88	0.848		
	CI5	0.84	0.809		
Technological newness	TN1	0.98	0.959	0.977	0.975
	TN2	0.96	0.947		
	TN3	0.97	0.947		
Market newness	MN1	0.92	0.828	0.904	0.914
	MN2	0.96	0.895		
	MN3	0.77	0.712		
New product performance	NPP1	0.89	0.821	0.924	0.925
	NPP2	0.89	0.832		
	NPP3	0.90	0.852		

Notes: Fit indices: $\chi^2(71) = 210.65$, NNFI = 0.97, CFI = 0.98, IFI = 0.98 and SRMR = 0.057

accurately than other. The model fit indices were $\chi^2 = 210.65$ with df = 71, NNFI = 0.97, CFI = 0.98, IFI = 0.98 and SRMR = 0.057, indicating that the model was acceptable (Hu and Bentler, 1999). All factor loadings were larger than 0.70 and all *t*-values were greater than 2.0 (Fornell and Larcker, 1981), demonstrating convergent validity. Moreover, the average variance extracted (AVE) values for all constructs were greater than 0.50, which further confirmed convergent validity.

To check discriminant validity, we built a constrained CFA model in which the correlations between the paired constructs were fixed to one. This was compared with the original unconstrained model, in which the correlations among constructs were freely estimated. All differences of χ^2 were significant at the 0.01 level, indicating sufficient discriminant validity. Furthermore, we assessed discriminant validity by comparing the relationship between shared variances among constructs and the AVE values as suggested by Paulraj *et al.* (2008). As shown in Table III, none of the correlations between constructs was greater than the square root of the related AVE value, which provides further evidence of discriminant validity.

As presented in Table III, only two inter-construct correlations were larger than the benchmark of 0.60. However, multicollinearity test revealed that multicollinearity did not appear to be a problem.

5. Analysis results

In this study, SPSS 22 was used to test the research hypotheses. This software allowed for the calculation of ΔR^2 among different regression models. Following Venkatraman's (1989) suggestion, we conducted hierarchical moderated regression analysis to test the hypotheses. This technique is appropriate for the model specifying the dependent variable (new product performance) is jointly determined by the interactions of the predictor (CI) and the moderators (TN and MN) (Prajogo, 2016). First, we added control variables into the model; second, the predictor and moderators; third, the two-way interactions of the predictor and moderators; and fourth, the three-way interaction. Before forming the interactions, the predictor and moderators were mean-centered to minimize potential multicolinearity problems (Aiken and West, 1991). The results are shown in Table IV.

As depicted in Table IV, the relationship between CI and new product performance is positive and significant ($\beta = 0.193$, $p < 0.01$). Thus, *H1* is supported. This is consistent with the previous findings (e.g. Lau, 2011; Mishra and Shah, 2009). Following existing literature (e.g. Hekman *et al.*, 2009; Shalley *et al.*, 2009), *H4* was first tested. As shown in Table IV, the increase in R^2 from models 3 to 4 is 0.010, and it is significant ($p < 0.05$), which indicates that the inclusion of the three-way interaction

Constructs	Mean	SD	1	2	3	4	5
1. Customer involvement	4.697	1.100	*0.819*				
2. Technological newness	4.951	1.056	0.645***	*0.963*			
3. Market newness	4.851	0.921	0.523***	0.633***	*0.884*		
4. New product performance	5.083	0.921	0.515***	0.572***	0.517***	*0.897*	
5. Firm size	5.715	1.572	0.212**	0.167*	0.202**	0.001	
6. Firm age	2.446	0.787	0.095	0.008	0.054	−0.021	0.500***

Notes: Square root of AVE is on the diagonal. *$\alpha = 0.05$; **$\alpha = 0.01$; ***$\alpha = 0.001$

Table III. Properties of measurement scales

Table IV. Results of hierarchical moderated regression analysis

Variables	Model 1	Model 2	Model 3	Model 4
Control variables				
Firm size	0.043	−0.123*	−0.130*	−0.134*
Firm age	−0.016	0.064	0.082	0.079
Metal products	0.180*	0.079	0.085****	0.081
Machinery	0.147****	0.002	0.033	0.034
Electrical machinery and equipment	0.120	0.082	0.092****	0.086
Communication and computers related equipment	0.001	0.042	0.048	0.043
Instruments and related products	0.220**	0.169**	0.174**	0.180***
Main effects				
Customer involvement (CI)		0.193**	0.181**	0.237***
Technological newness (TN)		0.374***	0.245***	0.220***
Market newness (MN)		−0.130	−0.082	0.012
Two-way interactions				
CI × TN			−0.146**	−0.135*
CI × MN			0.150*	0.174*
TN × MN			−0.048	−0.034
Three-way interaction				
CI × TN × MN				−0.167*
F	2.002****	22.044***	19.044***	18.284***
R^2	0.064	0.521	0.553	0.563
ΔR^2		0.457	0.032	0.010
F change for ΔR^2		64.489***	4.856**	4.307*

Notes: $*\alpha = 0.05$; $**\alpha = 0.01$; $***\alpha = 0.001$; $****\alpha = 0.10$

among CI, TN and MN significantly increased 1.0 percent of the explanation of variance in new product performance. In addition, model 4 in Table IV indicates that the coefficient for the three-way interaction effect is negative and significant ($\beta = -0.167$, $p < 0.05$). These findings provide support for *H4*.

To further assess the nature of the three-way interaction, we computed the slopes of the simple regression equations of new product performance on CI for each of the four configurations of low and high levels of TN and MN (i.e. one standard deviation below and above their respective means) and examined whether each simple slope was significantly different from 0 (Aiken and West, 1991). The results of the slope tests indicated that the effect of CI on new product performance was the most positive and significant under low TN and high MN (simple slope = 0.702, $p < 0.001$). Interestingly, the effect of CI on new product performance was positive but insignificant under high TN and low MN (simple slope = 0.097, $p > 0.10$), high TN and high MN (simple slope = 0.092, $p > 0.10$) and low TN and low MN (simple slope = 0.057, $p > 0.10$). Following Dawson and Richter's (2006) method, we graphed the four preceding simple regression lines. As shown in Figure 2, the different slopes of these simple regression lines suggested that the effects of CI on new product performance are different across the different configurations of TN and MN.

In addition, Figure 2 shows that the positive slope of new product performance that regressed on CI under low TN and high MN was far greater than the positive slope under high TN and low MN. To test whether the difference between this pair of simple slopes was significantly different from 0, we took a supplementary analysis of slope difference following Dawson and Richter's (2006) approach. The results indicated that the simple slope under low TN and high MN was significantly greater than the simple slope under high TN and low MN ($\Delta\beta = 0.605$, $p < 0.001$). This finding demonstrated that CI generates much higher performance when TN is low and MN is high than when TN is high and MN is low.

Finally, we examined *H2* and *H3*. However, we did not interpret the two-way interactions because their effects on new product performance depend on a variable that is not included in the interaction if the effect of three-way interaction is significant (Aiken and West, 1991). As shown in Table IV, the increase in R^2 from models 2 to 3 is significant ($\Delta R^2 = 0.032$, $p < 0.01$). Model 3 reveals that the coefficient for the two-way interaction between CI and TN is negative and significant ($\beta = -0.146$, $p < 0.01$). This result provides support for *H2*. In addition, model 3 indicates that the coefficient for the two-way interaction between CI and MN is positive and significant ($\beta = 0.150$, $p < 0.05$). Thus, *H3* is supported.

6. Discussion and implications

6.1 Discussion

This study aims to enrich the CI research by simultaneously examining the individual and joint moderating effects of TN and MN on the relationship between CI and new product performance. Our findings reveal that MN has a positive and significant moderating effect on the CI-new product performance relationship, while the moderating effect of TN is negative and significant. This finding is consistent with the argument of Heiskanen *et al.* (2007) that customers are sometimes likely to be resistant toward radically innovative product, which may weaken the advantage of CI. This study also indicates that, as expected, when TN is low and MN is high, CI has the most positive impact on new product performance. Interestingly, the performance effects of CI become insignificant under other three configurations of TN and MN. This finding highlights the potential risks and costs of implementing CI. These findings show distinct impacts of CI on new product performance under the simultaneous influence of TN and MN. Further inspection of four simple regression lines (see Figure 2) illustrates how the direction and magnitude of the CI-new product performance relationship are influenced by TN and MN concurrently. Specifically, when TN is low, the performance effect of CI improved from positive but insignificant to positive and significant with the level of MN increasing. Although implementing CI may be beneficial due to the acquisition of resources and knowledge, products with low newness in both TN and MN may make the contribution of CI limited. Thus, CI may not enhance new product

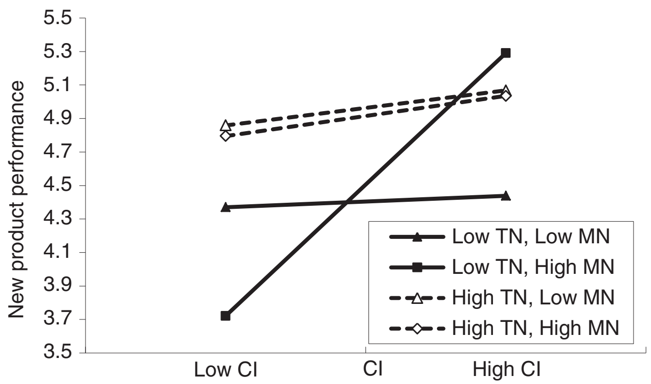

Figure 2. Joint moderating effects of TN and MN on the relationship between CI and new product performance

performance under conditions of low TN and MN. It appears that a high degree of MN strengthens the necessity of CI under a lower degree of TN. In other words, the ability of profiting from CI for firms that are developing innovative products in technology may depend greatly on whether or not firms are familiar with the market.

In contrast, when TN is high, the positive performance effect of CI decreased with the level of MN. These findings suggest that MN may have opposite moderating effects on the relationship between CI and new product performance, which became obvious when MN was examined in conjunction with TN. However, MN alone may be insufficient to necessitate CI because excessive newness in technology may render the implementation of CI unprofitable for firms when the level of TN is high. The findings that the positive relationships are not significant under the context of high TN are surprising but plausible because TN is likely to neutralize the potential benefits of CI.

Furthermore, when MN is low, the performance effect of CI increased with the level of TN. This finding indicates that firms with idiosyncratic resources, such as CI, will not be able to continue to exploit these resources to gain a competitive advantage if their new products remain relatively low MN. However, when MN is high, the performance effect of CI decreased considerably with the level of TN, and the effect is the most positive at a low level of TN while the positive effect is insignificant at a high level of TN. These findings are remarkable because the previous CI research studies on the moderating effects of TN and MN are quite limited and have not investigated how the individual moderating effects of either TN or MN depend on the level of the other. Overall, it appears that TN and MN jointly interact with CI to affect the level of new product performance.

6.2 Theory contributions

Our research contributes to CI literature in several ways. First, this study highlights the economic value of CI under the joint influence of TN and MN. Our findings reveal that when combined, TN and MN synergistically moderate the positive effect of CI on new product performance. The performance effect of CI becomes increasingly positive as TN decreases and MN increases simultaneously. The highest level of new product performance is generated when CI and MN are high and TN is low. That is, CI plays an important role in helping firms to be successful in a new product project characterized by low TN and high MN. These findings might serve as supporting evidence for the contingent RBV, which demonstrates that the value of a firm's unique resources may depend upon certain conditions (Aragon-Correa and Sharma, 2003). In addition, our findings might also offer support to the dynamic capabilities perspective, which suggests that a firm should match its resources and capabilities with the requirements of the NPD to achieve profitable performance (Teece, 2007). CI can help firms reconfigure their specialized resources, and thus, the importance of CI is amplified when the new product is low TN and high MN.

Second, our findings further indicate that the performance effect of CI is contingent on the levels of TN and MN. Contrary to traditional wisdom, a higher level of CI is not always better. Although CI contributes substantially to performance under conditions of low TN and high MN, firms cannot profit a lot from CI under other three configurations of TN and MN. In essence, TN and MN jointly form the boundary conditions and limits of the value of CI. From the perspective of strategic fit (Grant, 2010; Zajac *et al.*, 2000), the level of CI should fit with the specific level of product innovativeness that are formed by TN and MN to enhance new product performance.

Third, this study suggests that CI is more effective when developing products with MN than when coping with TN. The performance effect of CI is positive and significant when TN is low and MN is high, while it is insignificant when TN is high and MN is low. That is, high MN justifies the implementation of CI rather than high TN. Moreover, the performance effect of CI is further augmented by the combination of SC and CI. In other words, the contribution of CI under either TN or MN depends on the level of the other. Thus, the moderating effect of TN becomes positive under low level of MN. Our findings also suggest that the increase in the value of CI that occurs due to MN will be limited unless strong low TN is also present.

Finally, the results of our study indicate that the coexistence of TN and MN generates different forms of interactions that differently influence the effect of CI on new product performance. These findings could serve as supporting evidence that TN and MN work together to influence the effectiveness of collaborative innovation decisions. Thus, this study shows that differentiating product innovativeness and examining their joint effects employing a configurational approach may be particularly useful for providing important theoretical and managerial insights.

6.3 Managerial implications

Our findings also offer practical guidelines for managers. First, our research suggests that CI is important for firms that pursue to enhance new product performance. To ensure the success of innovative products, firms should cultivate a culture for collaborating with their customers to co-create value (Campbell, 2003; Sawhney *et al.*, 2005). Managers should encourage employees to commit to CI to exploit market opportunities and lower failure rates of new products. In addition, managers should provide support for CI efforts.

Second, managers should focus on product newness in technology and market when evaluating the values of CI. Disregarding either TN or MN will weaken a firm's ability to profit from CI. Since implementing CI may be costly and risky, managers should fit their firms' CI efforts with the requirements of NPD. If firms implementing CI do not correctly match their resources and capabilities with the requirements of innovative products, they are likely to implement CI in the wrong directions and/or at improper levels.

Third, managers should also be informed that the value of CI differs across configurational product innovativeness and enjoys highest performance under low TN and high MN. To effectively allocate and utilize resources, a firm should align the level of CI with the requirements of innovative products. For a product with low TN and high MN, a firm needs to be proactive to implement CI if it wants to translate the innovative product into profitable opportunities. However, in other configurations of TN and MN, a firm need not be very active in implementing CI because the effect of CI on new product performance is rather weak. Under such scenarios, firms should slow or cut some of their investments in activities related to CI. In sum, managers should adapt their firms' levels of CI to fit with the requirements of innovative products and to take advantage of the opportunities created by these conditions in order to achieve superior performance.

7. Limitations and future directions

This study has some limitations that provide opportunities for future research. First, the cross-sectional design of this study may limit our ability to make causal inferences about the relationship between CI and new product performance. While we have proposed that CI has a positive impact on new product performance, it is possible that the direction of causality may be reversed. However, we made several efforts to remove this concern. Previous findings generally support the argument that CI contributes to performance improvement rather than firms with high performance are more likely to implement

CI (Feng and Wang, 2013; Lau, 2011; Mishra and Shah, 2009). Our interviews with executives indicate that one of the most important goals of implementing CI is to improve new product performance. Future research using a longitudinal design would increase our certainty regarding the causality of the hypothesized relationships.

Second, the use of self-reported data by a single informant in each firm may generate CMV concerns and thus inflate the relationship between CI and new product performance (Feldman and Lynch, 1988). The potential influence of CMV should be taken into account when interpreting our findings. However, self-reported data are not inherently flawed and CMV issues may be overstated, especially given the complex nature of the interaction effects in our research (Shalley *et al.*, 2009; Siemsen *et al.*, 2010). In addition, the results of statistical remedies suggest that CMV is not serious. Nevertheless, future research could survey multiple respondents in each firm to enhance the reliability of findings.

Third, our study examines the joint moderating effects of TN and MN. However, other factors, such as market conditions and organizational learning orientation may also influence the relationship between CI and new product performance. Future research therefore could examine whether and how configurations of other environmental and organizational factors affect the impact of CI on new product performance. Additionally, future research could investigate whether the moderating effects of TN and MN depend on any additional factors, such as the stage of NPD process to enrich the research implications.

Finally, the underlying mechanisms through which CI influences new product performance (i.e. the possible mediator) are still unclear. However, few research studies have empirically examined this important but ignored issue. Future research may provide useful insights into management practices by exploring why and how other factors, such as knowledge integration may serve as the pathways that mediate the link between CI and new product performance.

References

Aiken, L.S. and West, S.G. (1991), *Multiple Regression: Testing and Interpreting Interactions*, Sage Publications, Newbury Park, CA.

Aragon-Correa, J.A. and Sharma, S. (2003), “A contingent resource-based view of proactive corporate environmental strategy”, *Academy of Management Review*, Vol. 28 No. 1, pp. 71-88.

Armstrong, J.S. and Overton, T. (1977), “Estimating non-response bias in mail surveys”, *Journal of Marketing Research*, Vol. 14 No. 3, pp. 396-402.

Barney, J. (1991), “Firm resources and sustained competitive advantage”, *Journal of Management*, Vol. 17 No. 1, pp. 99-120.

Calantone, R.J., Chan, K. and Cui, A.S. (2006), “Decomposing product innovativeness and its effects on new product success”, *Journal of Product Innovation Management*, Vol. 23 No. 5, pp. 408-421.

Campbell, A.J. (2003), “Creating customer knowledge competence: managing customer relationship management programs strategically”, *Industrial Marketing Management*, Vol. 32 No. 5, pp. 375-383.

Campbell, A.J. and Cooper, R.G. (1999), “Do customer partnerships improve new product success rates?”, *Industrial Marketing Management*, Vol. 28 No. 5, pp. 507-519.

Carbonell, P., Escudero, A.I.R. and Aleman, J.L.M. (2004), “Technology newness and impact of go/no-go criteria on new product success”, *Marketing Letters*, Vol. 15 Nos 2-3, pp. 81-97.

Carbonell, P., Rodríguez-Escudero, A.I. and Pujari, D. (2009), "Customer involvement in new service development: an examination of antecedents and outcomes", *Journal of Product Innovation Management*, Vol. 26 No. 5, pp. 536-550.

Chao-Ton, S., Yung-Hsin, C. and Sha, D.Y. (2006), "Linking innovative product development with customer knowledge: a data-mining approach", *Technovation*, Vol. 26 No. 7, pp. 784-795.

Chen, I.J. and Paulraj, A. (2004), "Towards a theory of supply chain management: the constructs and measurements", *Journal of Operations Management*, Vol. 22 No. 2, pp. 119-150.

Cote, J.A. and Buckley, M.R. (1987), "Estimating trait, method, and error variance: generalizing across 70 construct validation studies", *Journal of Marketing Research*, Vol. 24 No. 3, pp. 315-318.

Dawson, J.F. and Richter, A.W. (2006), "Probing three-way interactions in moderated multiple regression: development and application of a slope difference test", *Journal of Applied Psychology*, Vol. 91 No. 4, pp. 917-926.

Dess, G.G., Lumpkin, G.T. and Covin, J.G. (1997), "Entrepreneurial strategy making and firm performance: tests of contingency and configurational models", *Strategic Management Journal*, Vol. 18 No. 9, pp. 677-695.

Drazin, R. and van de Ven, A.H. (1985), "Alternative forms of fit in contingency theory", *Administrative Science Quarterly*, Vol. 30 No. 4, pp. 514-539.

Fang, E. (2008), "Customer participation and the trade-off between new product innovativeness and speed to market", *Journal of Marketing*, Vol. 72 No. 4, pp. 90-104.

Feldman, J.M. and Lynch, J. (1988), "Self-generated validity and other effects of measurements on belief, attitude, intention, and behavior", *Journal of Applied Psychology*, Vol. 73 No. 3, pp. 421-435.

Feng, T. and Wang, D. (2013), "Supply chain involvement for better product development performance", *Industrial Management & Data Systems*, Vol. 113 No. 2, pp. 190-206.

Feng, T., Sun, L. and Zhang, Y. (2010), "The effects of customer and supplier involvement on competitive advantage: an empirical study in China", *Industrial Marketing Management*, Vol. 39 No. 8, pp. 1384-1394.

Feng, T., Sun, L., Sohal, A.S. and Wang, D. (2014), "External involvement and firm performance: is time-to-market of new products a missing link?", *International Journal of Production Research*, Vol. 52 No. 3, pp. 727-742.

Flynn, B.B., Huo, B. and Zhao, X. (2010), "The impact of supply chain integration on performance: a contingency and configuration approach", *Journal of Operations Management*, Vol. 28 No. 1, pp. 58-71.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 29-50.

Garcia, R. and Calantone, R. (2002), "A critical look at technological innovation typology and innovativeness terminology: a literature review", *Journal of Product Innovation Management*, Vol. 19 No. 2, pp. 110-132.

Grant, R.M. (2010), *Contemporary Strategy Analysis*, 7th ed., John Wiley & Sons Ltd, West Sussex.

Gruner, K.E. and Homburg, C. (2000), "Does customer interaction enhance new product success?", *Journal of Business Research*, Vol. 49 No. 1, pp. 1-14.

Hatch, M.J. and Cunliffe, A.L. (2006), *Organization Theory: Modern, Symbolic, and Postmodern Perspectives*, 2nd ed., Oxford University Press, New York, NY.

Heiskanen, E., Hyvönen, K., Niva, M., Pantzar, M., Timonen, P. and Varjonen, J. (2007), "User involvement in radical innovation: are consumers conservative?", *European Journal of Innovation Management*, Vol. 10 No. 4, pp. 489-509.

Hekman, D.R., Bigley, G.A., Steensma, H.K. and Hereford, J.F. (2009), "Combined effects of organizational and professional identification on the reciprocity dynamic for professional employees", *Academy of Management Journal*, Vol. 52 No. 3, pp. 506-526.

Hu, L. and Bentler, P.M. (1999), "Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives", *Structural Equation Modeling*, Vol. 6 No. 1, pp. 1-55.

Hult, G.T.M., Hurley, R.F. and Knight, G.A. (2004), "Innovativeness: its antecedents and impact on business performance", *Industrial Marketing Management*, Vol. 33 No. 5, pp. 429-438.

Jayaram, J., Xu, K. and Nicolae, M. (2011), "The direct and contingency effects of supplier coordination and customer coordination on quality and flexibility performance", *International Journal of Production Research*, Vol. 49 No. 1, pp. 59-85.

Johnson, W.H.A. and Luo, C. (2008), "NPD project timeliness: the project-level impact of early engineering effort and customer involvement", *International Journal of Product Development*, Vol. 6 No. 2, pp. 160-176.

Kim, S.L. and Yun, S. (2015), "The effect of coworker knowledge sharing on performance and its boundary conditions: an interactional perspective", *Journal of Applied Psychology*, Vol. 100 No. 2, pp. 575-582.

Lau, A.K. (2011), "Supplier and customer involvement on new product performance: contextual factors and an empirical test from manufacturer perspective", *Industrial Management & Data Systems*, Vol. 111 No. 6, pp. 910-942.

Lau, A.K.W., Tang, E. and Yam, R.C.M. (2010), "Effects of supplier and customer integration on product innovation and performance: empirical evidence in Hong Kong manufacturers", *Journal of Product Innovation Management*, Vol. 27 No. 5, pp. 761-777.

Lumpkin, G.T. and Dess, G.G. (2001), "Linking two dimensions of entrepreneurial orientation to firm performance: the moderating role of environment and industry life cycle", *Journal of Business Venturing*, Vol. 16 No. 5, pp. 429-451.

Lundkvist, A. and Yakhlef, A. (2004), "Customer involvement in new service development: a conversational approach", *Managing Service Quality*, Vol. 14 Nos 2/3, pp. 249-257.

Menguc, B., Auh, S. and Yannopoulos, P. (2014), "Customer and supplier involvement in design: the moderating role of incremental and radical innovation capability", *Journal of Product Innovation Management*, Vol. 31 No. 2, pp. 313-328.

Millson, M.R. (2013), "Exploring the moderating influence of product innovativeness on the organizational integration-new product market success relationship", *European Journal of Innovation Management*, Vol. 16 No. 3, pp. 317-334.

Mishra, A.A. and Shah, R.R. (2009), "In union lies strength: collaborative competence in new product development and its performance effects", *Journal of Operations Management*, Vol. 27 No. 4, pp. 324-338.

Molina-Castillo, F.J. and Munuera-Aleman, J.L. (2009), "The joint impact of quality and innovativeness on short-term new product performance", *Industrial Marketing Management*, Vol. 38 No. 8, pp. 984-993.

Narasimhan, R. and Jayaram, J. (1998), "Causal linkages in supply chain management: an exploratory study of North American manufacturing firms", *Decision Sciences*, Vol. 29 No. 3, pp. 579-605.

Narver, J.C., Slater, S.F. and MacLachlan, D.L. (2004), "Responsive and proactive market orientation and new-product success", *Journal of Product Innovation Management*, Vol. 21 No. 5, pp. 334-347.

Olson, E.M., Walker, O.C. and Ruekert, R.W. Jr (1995), "Organizing for effective new product development: the moderating role of product innovativeness", *Journal of Marketing*, Vol. 59 No. 1, pp. 48-62.

Paulraj, A., Lado, A.A. and Chen, I.J. (2008), "Inter-organizational communication as a relational competency: antecedents and performance outcomes in collaborative buyer-supplier relationships", *Journal of Operations Management*, Vol. 26 No. 1, pp. 45-64.

Peng, D.X., Heim, G.R. and Mallick, D.N. (2014), "Collaborative product development: the effect of project complexity on the use of information technology tools and new product development practices", *Production and Operations Management*, Vol. 23 No. 8, pp. 1421-1438.

Pfeffer, J. (1997), *New Directions for Organization Theory: Problems and Prospects*, Oxford University Press, New York, NY.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003), "Common method variance in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.

Prajogo, D.I. (2016), "The strategic fit between innovation strategies and business environment in delivering business performance", *International Journal of Production Economics*, Vol. 171, pp. 241-249.

Rousseau, D.M. and Fried, Y. (2001), "Location, location, location: contextualizing organizational research", *Journal of Organizational Behavior*, Vol. 22 No. 1, pp. 1-13.

Salomo, S., Steinhoff, F. and Trommsdorff, V. (2003), "Customer orientation in innovation projects and new product development success-the moderating effect of product innovativeness", *International Journal of Technology Management*, Vol. 26 No. 5, pp. 442-463.

Sawhney, M., Verona, G. and Prandelli, E. (2005), "Collaborating to create: the internet as a platform for customer engagement in product innovation", *Journal of Interactive Marketing*, Vol. 19 No. 4, pp. 4-17.

Shalley, C.E., Gilson, L.L. and Blum, T.C. (2009), "Interactive effects of growth need strength, work context, and job complexity on self-reported creative performance", *Academy of Management Journal*, Vol. 52 No. 3, pp. 489-505.

Siemsen, E., Roth, A. and Oliveira, P. (2010), "Common method bias in regression models with linear, quadratic, and interaction effects", *Organizational Research Methods*, Vol. 13 No. 3, pp. 456-476.

Song, X.M. and Parry, M.E. (1997), "The determinants of Japanese new product successes", *Journal of Marketing Research*, Vol. 34 No. 1, pp. 64-76.

Story, V.M., Boso, N. and Cadogan, J.W. (2015), "The form of relationship between firm-level product innovativeness and new product performance in developed and emerging markets", *Journal of Product Innovation Management*, Vol. 32 No. 1, pp. 45-64.

Szymanski, D.M., Kroff, M.W. and Troy, L.C. (2007), "Innovativeness and new product success: insights from the cumulative evidence", *Journal of the Academy of Marketing Science*, Vol. 35 No. 1, pp. 35-52.

Tan, C.L. and Tracey, M. (2007), "Collaborative new product development environments: implications for supply chain management", *Journal of Supply Chain Management*, Vol. 43 No. 3, pp. 2-15.

Tatikonda, M.V. and Rosenthal, S.R. (2000), "Technology novelty, project complexity, and product development project execution success: a deeper look at task uncertainty in product innovation", *IEEE Transactions on Engineering Management*, Vol. 47 No. 1, pp. 74-87.

Teece, D.J. (2007), "Explicating dynamic capabilities: the nature and micro foundations of (sustainable) enterprise performance", *Strategic Management Journal*, Vol. 28 No. 13, pp. 1319-1350.

Tsai, K.H. and Yang, S.Y. (2013), "Firm innovativeness and business performance: the joint moderating effects of market turbulence and competition", *Industrial Marketing Management*, Vol. 42 No. 8, pp. 1279-1294.

Tsai, K.H., Liao, Y.C. and Hsu, T.T. (2015), "Does the use of knowledge integration mechanisms enhance product innovativeness?", *Industrial Marketing Management*, Vol. 46, pp. 214-223.

Veldhuizen, E., Hultink, E.J. and Griffin, A. (2006), "Modeling market information processing in new product development: an empirical analysis", *Journal of Engineering and Technology Management*, Vol. 23 No. 4, pp. 353-373.

Venkatraman, N. (1989), “The concept of fit in strategy research: toward verbal and statistical correspondence”, *Academy of Management Review*, Vol. 14 No. 3, pp. 423-444.

Wade, M. and Hulland, J. (2004), “Review: the resource-based view and information systems research: review, extension, and suggestions for future research”, *MIS Quarterly*, Vol. 28 No. 1, pp. 107-142.

Wagner, S.M. (2010), “Supplier traits for better customer firm innovation performance”, *Industrial Marketing Management*, Vol. 39 No. 7, pp. 1139-1149.

Wang, Q., Zhao, X. and Voss, C. (2016), “Customer orientation and innovation: a comparative study of manufacturing and service firms”, *International Journal of Production Economics*, Vol. 171, pp. 221-230.

Wernerfelt, B. (1984), “A resource-based view of the firm”, *Strategic Management Journal*, Vol. 5 No. 2, pp. 171-180.

Wiklund, J. and Shepherd, D. (2005), “Entrepreneurial orientation and small business performance: a configurational approach”, *Journal of Business Venturing*, Vol. 20 No. 1, pp. 71-91.

Zajac, E.J., Kraatz, M.S. and Bresser, R.K. (2000), “Modeling the dynamics of strategic fit: a normative approach to strategic change”, *Strategic Management Journal*, Vol. 21 No. 4, pp. 429-453.

Appendix. List of measurement items

Customer involvement

CI1: we consulted major customer early in the design efforts for the new product.
CI2: we partnered with major customer for developing new product.
CI3: major customer was an integral part of the design effort for the new product development.
CI4: major customer was frequently consulted about the design of the new product.
CI5: we have continuous improvement programs that include our major customer.

Technological newness

TN1: the new product represents a new or different technology.
TN2: in the new product development process, new types of engineering or design work were done.
TN3: the production technology and production process of the new product represent a new and different one for our firm.

Market newness

MN1: the new product aims at new customers to our firm that we had not sold before.
MN2: the market for the new product is new or different from the market we normally sell into.
MN3: the new product represents a new product category that we had not sold before.

New product performance

NPP1: the profitability of the new product is high relative to main competitors.
NPP2: the market share of the new product is high relative to main competitors.
NPP3: the growth in sales of the new product is fast relative to main competitors.

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