Management Decision

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Article information:

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Received 29 June 2017
Revised 24 March 2018
15 October 2018
Accepted 14 February 2019

Abstract

Purpose – The purpose of this paper is to review and re-examine the role of the organization-level determinants from the perspectives of competence-based views.

Design/methodology/approach – Regression analysis was used to test the hypotheses in a sample of 80 cases drawn from a population of the top 5,000 Taiwanese firms listed in the yearbook published by the China Credit Information Service Incorporation.

Findings – The empirical results indicate that formalization is positively related to new product performance while decentralization has an inverse U-shaped curvilinear effect on new product performance. Furthermore, the regression findings also indicate that market-oriented strategy negatively moderates the relationship between formalization and new product performance, while technology-oriented strategy positively moderates the curvilinear relationship between decentralization and new product performance.

Originality/value – Extant literatures have paid attention to investigating the determinants to the performance of the new product development, but some of the results, such as in the organizational levels, are confusing and mixed. Contrary to previous works, the purpose of this paper is to review and re-examine the role of the organization levels determinants from the perspectives of competence-based view.

Keywords Organizational structure, New product performance, Strategic orientation

Paper type Research paper

1. Introduction

In today's highly competitive marketplace, characterized by unstable consumer preference and short product lifecycles, firms are under pressure to develop new products and services that are both timely and responsive to customer needs (Calantone *et al.*, 2010). However, many companies have changed their organizational structures to become more responsive to customer needs. In this vein, some studies have revealed the important role of organizational structures in the development of new products (Hitt *et al.*, 1996; Im and Workman, 2004; Lei *et al.*, 1999; Menguc and Auh, 2010; Olson *et al.*, 1995; Wei *et al.*, 2014). Moreover, little previous empirical evidence has connected the effect of organizational structures, including both formalization and centralization, to new product performance (Auh and Menguc, 2007; Chen, 2007; Covin and Slevin, 1989; Damanpour, 1991; Gupta and Wilemon, 1988; Hage and Dewar, 1973; Moenaert *et al.*, 1994; Mu *et al.*, 2017; Pattikawa *et al.*, 2006; Sethi *et al.*, 2001; Yap *et al.*, 1998). This study, therefore, contends that formalization and centralization have different effects on the performance of the new product development projects and empirically examines this issue.

A firm's customer response capability is associated with its strategic orientation. As Chandler (1962) stated, "A firm's strategy would dictate its organizational structure, and to the extent that the strategy and structure combination was optimal." The alignment between organizational structure and its strategy orientation, therefore, has positive implications for performance. Therefore, previous literature has argued that strategic

Management Decision

0025-1747
DOI 10.1108/MD-06-2017-0628

orientation would influence organizational structure (Chandler, 1962; Miles and Snow, 1978; Miller and Friesen, 1984; Mu *et al.*, 2017; Rumelt, 1974; Venkatraman, 1989; Venkatraman and Camillus, 1984), and the interaction of organizational structure and strategic orientation is directly related to new product performance (Boyd and Fulk, 1996; Dekoulou and Trivellas, 2017; Dess and Keats, 1987; Nandakumar *et al.*, 2010; Pattikawa *et al.*, 2006). In other words, though organizational structures play a critical role in explaining new product performance, some contingency factors such as strategic orientation may affect their impact on new product development.

Figure 1 presents the research model and the proposed hypotheses of this study. The remainder of the paper proceeds as follows. The next section considers the literature and sets out the hypotheses. The methodology for the study follows. Then, the paper presents the results of the empirical study in achieving its goals. Discussion and conclusions are provided in the last section.

2. Literature review and hypotheses

2.1 Organizational structure and new product performance

New product development is a distinctive competence which may be a potent source of sustainable competitive advantage in the product market (Calantone *et al.*, 2010; Mahoney and Pandian, 1992; Marsh and Stock, 2003). In new product development, the most important way for a firm to obtain distinctive competence so that it can respond to customer demand faster than its competitors is to accumulate competence through organizational structure (Alavi and Leidner, 2001; Gatignon and Xuereb, 1997; Gupta *et al.*, 1997; Leonard-Barton, 1992; Pertusa-Ortega *et al.*, 2010; Prahalad and Hamel, 1990; Tampoe, 1994). Therefore, organizational structure is likely to affect new product performance according to the competence-based view (Atuahene-Gima and Wei, 2011; Prahalad and Hamel, 1990; Slater *et al.*, 2014). Following the competence-based view, an effective organizational structure provides new product development projects with the formal system and design to coordinate work and promote better product innovation capability (Hitt *et al.*, 1996; Im and Workman, 2004; Lei *et al.*, 1999; Menguc and Auh, 2010; Olson *et al.*, 1995). The competence-based view is a theoretical perspective that allows us to elucidate the potential effects of organizational structure on new product performance. In essence, this theory suggests that organizational structure plays an important role in forming managerial competency and, ultimately, new product performance (Forés and Camisón, 2016; Gupta *et al.*, 1997; Lado *et al.*, 1992; Leonard-Barton, 1992; Tampoe, 1994). The effect of the organizational structure on new product performance is based on how

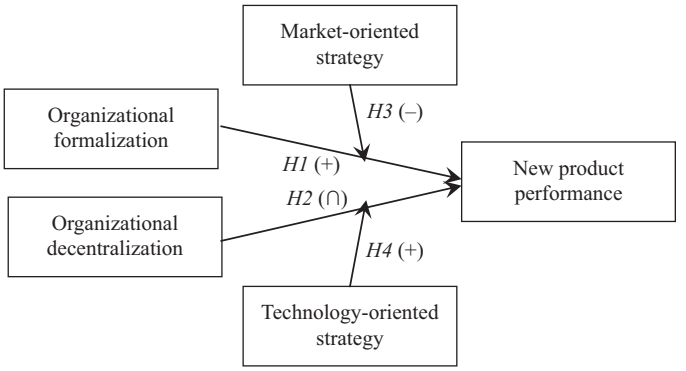

Figure 1.
The research model and the hypotheses

this managerial competency is used to coordinate and integrate resources, facilitate information and provide a mechanism for decision making and conflict resolution (Lei *et al.*, 1999; Olson *et al.*, 1995).

In previous studies, organizational structure is usually categorized into two elements: (in) formalization and (de)centralization (Auh and Menguc, 2007; Chen, 2007; Covin and Slevin, 1989; Damanpour, 1991; Foss *et al.*, 2015; Gupta and Wilemon, 1988; Hage and Dewar, 1973; Moenaert *et al.*, 1994; Pattikawa *et al.*, 2006; Sethi *et al.*, 2001; Yap *et al.*, 1998). These two dimensions of organizational structure imply that in the new product development process, firms are likely to deploy formal mechanisms that increase role clarity, reduce role conflict and impose discipline on chaotic new product development activities (Cooper, 2008; Poskela and Martinsuo, 2009; Sethi and Iqbal, 2008; Srivastava, 1991; Tushman and Anderson, 1997). Moreover, an optimal level of decentralization exists for the new product development projects to achieve better performance due to the reconciliation of positive and negative forces governing the relationship between decentralization and new product performance (Calantone *et al.*, 2010; Leenders *et al.*, 2007).

2.1.1 Formalization. Formalization is the extent to which institutionalized work rules or standard operating procedure, including the job description, norm and policy, are used to govern the interaction among individuals in new product development projects (Andrews and Kacmar, 2001; Pugh *et al.*, 1968). The long-term accumulated organizational routines through formalization can be viewed as a kind of managerial competency (Lado *et al.*, 1992). This managerial competency is usually embedded in the process that guides individuals on how to work on temporary project teams. In fact, a formalized structure may be beneficial to new product development projects (Barczak *et al.*, 2008; Nijssen and Frambach, 2000) since the development of new products may be designed for teamwork processes in each of these elements of the product innovation activity and require higher formal project planning and control to ensure project progress. For instance, as representatives from R&D, manufacturing and marketing gather in a meeting room to explore new product characteristics and develop an innovative product concept. Such formal settings can not only foster project efficiency by consciously and formally explicating all relevant elements of the product concept (e.g. the specification of deliverables and deadlines), but conduct more formal exchanges among themselves and with experts in other functional areas (Bonner *et al.*, 2002; Persaud, 2005; Tatikonda and Rosenthal, 2000). Therefore, formalization facilitates the expeditious development of a new product according to the competence-based view (Nohria and Ghoshal, 1997; Poskela and Martinsuo, 2009; Srivastava, 1991; Tushman and Anderson, 1997).

In addition, formalized procedures can bring discipline and direction to chaotic new product development activity (Bartol and Martin, 1991; Cooper, 2008; Sethi and Iqbal, 2008), and manage the process for improved new products, enhanced efficiency and faster introduction of new products (Beckmann *et al.*, 2007; Hambrick, 1980; Meirovich *et al.*, 2007; Tatikonda, 1999; Walker and Ruekert, 1987). Following this line of logic, the following hypothesis is developed:

H1. Organizational formalization is positively related to new product performance.

2.1.2 Decentralization. Decentralization is the degree of autonomy new project development team members have in determining what work to do and how to do it (Galbraith and Kazanjian, 1986; Martinez and Jarillo, 1989). According to the competence-based view, autonomy is an important determinant of performance. Autonomy helps foster positive outcomes like work engagement, providing a mechanism by information exchange between team members and enhancing managerial competency in a changing environment (Lado *et al.*, 1992; Cohen and Levinthal, 1990; Hitt *et al.*, 1996). Owing to the increasing

importance of autonomy in the new product development teams, scholars recently have paid attention to decentralization (Devinney, 1995; Leenders *et al.*, 2007).

Two possible alternatives to decentralization exist for new product development project's choice (Calantone *et al.*, 2010; Leenders *et al.*, 2007). One is the use of decentralized structures to encourage members to make critical decisions in the development of new products (Damanpour, 1991; Swamidass and Newell, 1987), and the other is a non-participatory centralized hierarchy to concentrate decision-making authority within a few positions (Ayers *et al.*, 1997; Chen and Huang, 2007). Prior studies have provided mixed results on the choice of the two alternatives. Some scholars suggest adopting the decentralized structures (Olson *et al.*, 1995; Sethi *et al.*, 2001), while others propose utilizing the centralized hierarchy to improve the development of new products (Adler, 1999; Kohli and Jaworski, 1990).

Some scholars have proposed that a non-linear relationship exists between decentralization and new product performance (Calantone *et al.*, 2010; Leenders *et al.*, 2007). In this study, we argue that there is an optimal level of decentralization for the new product development projects to achieve better performance due to the reconciliation of the positive and negative forces governing the relationship between decentralization and new product outcome.

Decentralization is suggested to be beneficial to the new product performance according to the competence-based view (e.g. Bucic and Gudergan, 2004; Leenders *et al.*, 2003; Nonaka *et al.*, 2000; Russell and Russell, 1992). Russell and Russell (1992) argue that decentralization can increase the delegation of authority and flexibility that facilitate the development of a new product. Nonaka *et al.* (2000) conclude that decentralized structures can help firms to enhance new product efficiency because decentralization can stimulate new members of the product team to generate more innovative ideas and valuable information exchange through a variety of function members. Decentralization will also improve new product performance by simplifying the decision-making process and generating more ideas (Ouchi, 2006). By building a participatory environment, decentralized structures can increase employee involvement, collaboration and creativity that lead to desirable new product outcomes (Bucic and Gudergan, 2004; Leenders *et al.*, 2003).

However, excessive decentralization has detrimental effects on new product performance in terms of higher coordination and communication costs (Adler, 1999; Auh and Menguc, 2007). Coordination and communication costs increase with decentralization (Leenders *et al.*, 2007). The emphasis on decentralization in the new product development projects would give team members greater autonomy to decide and act. The increased coordination and communication costs from a range of perspectives and opinions among members can complicate the reaching of a consensus (Horwitz and Horwitz, 2007; Nemeth and Staw, 1989). In addition, organizational decentralization is not conducive to resource utilization and cost effectiveness.

This paper, therefore, proposes that the effect of decentralization on new product performance is curvilinear. As positive and negative forces govern the relationship, there is an optimal level of decentralization for new product performance. Before the optimal level, the increase of decentralization would enhance new product performance. At the same time, new product performance would decrease as decentralization increases after the optimal level. Accordingly, we can expect decentralization to have a curvilinear effect on new product performance, which will first increase and then decrease when decentralization increases. This leads to the following hypothesis:

H2. The relationship between organizational decentralization and new product performance is inverse U-shaped, with the slope being positive at low levels of organizational decentralization and negative at high levels of organizational decentralization.

2.2 Moderating effects of strategy orientation

From the competence-based view, the successful development of a new product may help create longer-term competitive advantage (Calantone *et al.*, 2010; Mahoney and Pandian, 1992; Marsh and Stock, 2003). Strategic orientation is concerned with the decisions that firms make to gain a distinctive competitive advantage (Narver and Slater, 1990), which requires the proper alignment of the organizational design with appropriate strategy in the development of new products (Boyd and Fulk, 1996; Dess and Keats, 1987; Nandakumar *et al.*, 2010). Accordingly, strategic orientation may play the moderating role in the relations between organizational structure and new product performance (Danneels, 2002; Pattikawa *et al.*, 2006). Strategic orientation is defined as the strategic direction implemented by a firm to create the proper behaviors for the continuous superior performance of the business. It usually consists of two strategies: market-oriented and technology-oriented (Atuahene-Gima and Ko, 2001; Cheng and Huizingh, 2014; Gatignon and Xuereb, 1997; Jantunen *et al.*, 2008; Jaworski and Kohli, 1993; Pattikawa *et al.*, 2006; Slater and Narver, 1995).

A market-oriented strategy is a way to develop competitive advantage by listening to customers and offering them value and a solution (Deshpande *et al.*, 1993; Jaworski and Kohli, 1993; Kohli and Jaworski, 1990; Pattikawa *et al.*, 2006; Slater and Narver, 1995). In market-oriented strategies, market-sensing and customer-linking capabilities could be driven by an informal structure within the team that will enhance new product performance after responding to customer needs (Jaworski and Kohli, 1993; Kirca *et al.*, 2005; Slater and Narver, 1995). Accordingly, new product development projects might adopt market-oriented strategies more effectively in less hierarchical structures and, therefore, have a stronger impact on new product performance (Baker and Sinkula, 2005; Narver and Slater, 1990; Slater and Narver, 1995). In contrast, low market-oriented strategies encourage new product development projects to act on product-oriented suppliers (Slater and Narver, 1995), and thus benefit from formalization because of the clear road map it provides. A product-oriented manufacturer can enhance a new product's performance by streamlining and removing barriers to the smooth execution of product innovation (Auh and Menguc, 2007).

Accordingly, the implementation of low market-oriented strategies might benefit from formalization in new product development. Conversely, firms with highly market-oriented strategies and informal structures should have a strong impact on new product performance. Accordingly, a market-oriented strategy would not moderate the relationship between organizational formalization and new product performance. In light of this reasoning, the following hypothesis is developed:

H3. Market-oriented strategy negatively moderates the relationship between organizational formalization and new product performance.

H2 suggests that there is an inverse U-shaped relationship between organizational decentralization and new product performance. However, the slope of the relationship could vary in its strategic orientation. Based on the competence-based view, a technology-oriented strategy is a technological push concept, in which the customer will be attracted by an excellent new technology (Gatignon and Xuereb, 1997; Wind and Mahajan, 1997). In addition, technology orientation is an open-mind thought and willing to invest heavily in R&D and accept any kinds of new ideas to meet the customers' need (Zhou *et al.*, 2005). With these theoretical discussions in mind, organizational decentralization entails both bright and dark side effects in new product development. The rationale for our positive interaction between organizational decentralization and technology-oriented strategy rests on the argument that high levels of technology-oriented strategy can heighten the positive side effects while mitigating those that are associated with organizational decentralization in new product development projects.

On the one hand, some prior studies indicate that the increase in organizational decentralization can the stimulate members of the new product team to generate more

innovative ideas and valuable information exchange (Bucic and Gudergan, 2004; Souitaris, 2001), and thus increase the employee involvement, collaboration and creativity that enhance new product performance (Bucic and Gudergan, 2004; Leenders *et al.*, 2003; Ouchi, 2006). This competency can be strengthened if the decentralized teams adopt a technology-oriented strategy. A technology-oriented strategy could also provide decentralized teams with sufficient technological competences from past new product development projects and apply those competences into the development of future new products. A greater competence to access and build on previously created technological knowledge is likely to contribute to improved new product performance.

On the other hand, high levels of organizational decentralization produce unwanted coordination and communication costs. The degree to which such unwanted costs impair the performance of a new product, however, may depend upon the technology-oriented strategy that the teams implement. A technology-oriented strategy not only provides new product development teams with the abundant technological competences for new innovation ideas and opportunities, but also become the platform for sharing technological knowledge in a centralized organizational structure which results in increased commitment and collaboration (Pertusa-Ortega *et al.*, 2010).

In addition, a technology-oriented strategy generates the necessary R&D resources for coordination and communication. Accordingly, this study proposes that a technology-oriented strategy can strengthen the benefits of competency to encourage more authorization and adaption (Atuahene-Gima and Ko, 2001), while lessening the unwanted costs associated with the decentralization structure. Therefore, a technology-oriented strategy moderates the inverted U-shaped relation between organizational decentralization and new product performance.

This study proposes that a technology-oriented strategy can strengthen the benefits of delegation of authority, flexibility, idea generation, and knowledge sharing while lessening the coordination and communication costs. In other words, that is, technology-oriented strategy positively moderates the relationship between organizational decentralization and new product performance. This reasoning leads to the following hypothesis:

H4. Technology-oriented strategy positively moderates the relationship between organizational decentralization and new product performance.

3. Research methodology

3.1 Data collection and sample

The empirical study employed a questionnaire approach designed to collect data for testing the validity of the model and research hypotheses. Variables in the questionnaire included background information, organizational structure, strategy orientation and new product performance. All of the independent and dependent variables were assessed via seven-point Likert-type scales ranging from 1 (strongly disagree) to 7 (strongly agree). The sample for the study was drawn from population of the top 5,000 Taiwanese firms listed in the yearbook published by the China Credit Information Service Incorporation. This study empirically tests the model and hypotheses with data from electronics firms in Taiwan. The electronics industry is competitive and rapidly changing (Chen *et al.*, 2012). Such an environment highlights the importance of a firm's innovation activities. Moreover, even though Taiwan's electronics firms play important roles in the global supply chain and electronics market, they tend to be smaller than their major international rivals (Jean *et al.*, 2012). Thus, the Taiwanese electronics firms with relatively limited resources often have to rely on external stakeholders, such as foreign firms and independent board members to overcome difficulties in gaining the needed resources for innovation activities. Furthermore, during the 1997 financial crisis, the average returns of many firms in Taiwan, including electronics firms plunged. Taiwan's Government has

raised awareness about the critical role of innovation activities (Wu, 2008). In order to enhance the efficiency of innovation activities, firms characterized by strong family holdings and interfirm cross-holding have to adjusted their governance arrangement with more outside stakeholders, such as foreign ownership, institutional ownership and outside board members. The changes in organizational structure were critical in securing competitive advantage and achieving superior firm performance. For these reasons, the Taiwan's electronics industry is an interesting setting for examining how organizational structure and strategic alignment influence firm innovation.

A stratified random sampling method was used to divide the population into five non-overlapping groups or strata based on the total assets held by the top 5,000 companies in the CCIS. A stratified sample was randomly selected from five levels of the top 5,000 as follows: rankings 1–1,000; rankings 1,001–2,000; rankings 2,001–3,000; rankings 3,001–4,000; and rankings 4,001–5,000. A random stratified sampling method was used to select 90 firms in each of the five 1,000 levels and 450 questionnaires were distributed. Respondents were expected to be knowledgeable on a broad variety of aspects about the company concerning things like organizational structure, strategy orientation, and also about the firm's new product performance. The key informants were the top executives of the companies (i.e. presidents, vice-presidents, directors or general managers). Follow-up letters, e-mails and phone calls were done after two weeks. A total of 100 returned questionnaires were received and 5 of them are invalid or incomplete. The remaining 95 valid and complete questionnaires were used for quantitative analyses. It represents an effective response rate of 21.11 percent of the total. The possibility of non-response bias was checked by comparing the characteristics of the respondents to those of the original sample, and no statistically significant differences were observed in terms of industry type ($\chi^2 = 2.824$, $p = 0.901$), number of employees ($\chi^2 = 11.449$, $p = 0.075$) and firm age ($\chi^2 = 2.675$, $p = 0.848$).

Since all measures were collected in the same survey instrument, the possibility of common method bias was controlled by using the procedural remedies and statistical tests (Podasakoff *et al.*, 2003). In procedural remedies, we followed the recommendations proposed by Podasakoff *et al.* (2003) on the questionnaire design including psychological separation of predictor and criterion variables and response anonymity. We also conducted *post hoc* statistical tests of the influence of common method bias. Following prior studies (e.g. Atuahene-Gima and Li, 2004; Simonin, 1999), this study checked for the potential problem with the Harman's one-factor test. If common method variance was a serious problem, a single factor would emerge from a factor analysis or one general factor to account for the majority of covariance in the predictor or criterion variables (Podsakoff and Organ, 1986). A principal factor analysis on the questionnaire measurement items yielded five factors with eigenvalues greater than 1.0 that account for 66 percent of total variance and the first factor accounted for 18.10 percent of the variance. Since a single factor did not emerge and one general factor did not account for most of the variance, common method variance was unlikely to be a serious problem in the data (Podsakoff and Organ, 1986).

3.2 Measures

3.2.1 New product performance. Based on prior studies (e.g. Brown and Eisenhardt, 1995; Cooper and Kleinschmidt, 1987; Im and Workman, 2004), new product performance was measured by five items to reflect the extent of profit, sales, return on investment, market share and customer satisfaction. An exploratory principal component factor analysis with varimax rotation supported one dimension for new product performance with eigenvalue greater than 1 and explaining 70.95 percent of the variance[1]. The Cronbach's α coefficient for new product performance ($\alpha = 0.91$) is larger than 0.70, exceeding a threshold generally proposed in the literature (Hair *et al.*, 1998; Nunnally, 1978).

3.2.2 Organizational structure. Drawing upon the core ideas of previous literatures (e.g. Auh and Menguc, 2007; Damanpour and Gopalakrishna, 2001; Lysonski *et al.*, 1995), we adapted two dimensions of organizational structure including formalization and decentralization to reflect the extent to which firms design their organization to standardize the rules and procedures, and to authorize decision-making power. The formalization factor was assessed by four items measuring the extent to which employees followed the standard operation process and rules of company ($\alpha = 0.83$). The decentralization factor was measured with a four-item scale tapping the degree to which the respondents were authorized, provided opinions actively, participated in decision-making and quickly adjusted the process to face with the industrial change or customer' need ($\alpha = 0.71$). To assess the validity, multi-dimensionality and reliability of the constructs, this study assessed the underlying factor structure of the eight scale items using a principal component factor analysis with varimax rotation. The results supported two factors with eigenvalues greater than 1 and explain 61.56 percent of the variance. Each item loaded on its appropriate factor with primary loadings greater than 0.66, cross-loadings lower than 0.28 and the Cronbach's α coefficients in the two factors both loaded above the suggested value of 0.70 (Hair *et al.*, 1998).

3.2.3 Strategy orientation. According to prior studies (e.g. Atuahene-Gima and Ko, 2001; Gatignon and Xuereb, 1997; Jantunen *et al.*, 2008; Jaworski and Kohli, 1993; Pattikawa *et al.*, 2006; Slater and Narver, 1995), this study adapts two dimensions of market-oriented and technology-oriented strategy to examine their role in affecting new product performance. Market-oriented strategy was measured by six items to reflect the extent that the company focus more concentration on marketing information and price promotion than competitors and view the customer's need is the main source of competitive advantage($\alpha = 0.81$). Technology-oriented strategy was measured by four items to reflect the extent that the company focus more concentration on new technology and innovation than competitors and invest more profit on R&D budget ($\alpha = 0.87$). Acknowledging the strategy orientation dimensionality debate (Gatignon and Xuereb, 1997; Slater and Narver, 1995), factor analysis was used to reduce the ten items into two variables with an eigenvalue greater than 1 that can be interpreted as market-oriented strategy and technology-oriented strategy with acceptable Cronbach's α values (0.81 and 0.87, respectively).

3.2.4 Control variables. This study examines the effects of organizational structure and strategic orientation on new product performance, and thus includes in the model a range of controls to account for the firm-level (such as firm age and firm size) and industry-level (such as industry type) effects on new product performance. These measures build on past research on new product development efforts. The first group of the control variables that might affect new product performance related to the firm-level characteristics, such as firm age and size (Brown and Eisenhardt, 1995). Firm age was computed as the number of years from the founding date while firm size was measured as the number of full-time employees. In our model, a natural log transformation of the scores was used to avoid a violation of parametric analysis assumptions in terms of the skewed data, outliers and unequal variation. Moreover, the other group of variable captures characteristics of the industry type to which respondent firms are belonged to since firms in different industries might behave differently in new product performance (Atuahene-Gima, 1996; Hitt and Ireland, 1985). Two dummy variables were included for the industry type to indicate whether a firm belongs to manufacturing industry (1 = yes, 0 = no) or technology industry (1 = yes, 0 = no).

4. Results

This study attempted to understand the role of organizational structure and strategy orientation in determining new product performance. The hypotheses were tested by the hierarchal moderated regression analysis which allows for a comparison between

alternative models with and without interaction terms (Jaccard and Turrisi, 2003). The descriptive statistics and correlations for all measured variables in this study were indicated in Table I. To reduce the potential problem of multicollinearity, both independent and moderating variables were mean-centered before doing the hierarchical regression analysis (Aiken and West, 1991). Variance inflation factors (VIFs) were used to examine the effect of multicollinearity. The values of the VIFs associated with the predictors showed a range from 1.08 to 2.33, which fall within acceptable limits (Hair *et al.*, 1998), suggesting no need for concerns with respect to multicollinearity.

Table II displayed the results of the hierarchal moderated regression for combinations of the independent variables and moderating variables with new product performance as the dependent variable. Model 1 in Table II was the base model that includes the control variables.

Variables	Mean	SD	VIF	1	2	3	4	5	6	7	8	9
1. Manufacturing industry	0.41	0.50	2.33									
2. Technology industry	0.41	0.50	2.16	−0.70								
3. Firm age	4.53	2.22	1.34	0.46	−0.32							
4. Number of employees	3.19	1.79	1.08	−0.05	0.11	0.13						
5. Organizational formalization	5.33	1.01	1.30	0.27	−0.19	0.18	0.14	(0.83)[a]				
6. Organizational decentralization	4.86	1.03	1.21	−0.07	0.18	0.01	0.01	0.14	(0.71)			
7. Market-oriented strategy	4.61	0.88	2.01	0.01	0.08	0.16	0.15	0.37	0.38	(0.81)		
8. Technology-oriented strategy	5.00	1.06	1.70	−0.09	0.23	0.02	0.02	0.10	0.29	0.60	(0.87)	
9. New product performance	4.95	0.96		0.02	0.23	0.10	0.10	0.34	0.19	0.41	0.33	(0.91)

Notes: $n = 95$ (two-tailed test). Correlations with absolute value greater than 0.23 are significant at $p < 0.05$, and those greater than 0.33 are significant at $p < 0.01$. [a]α coefficients are shown in the diagonal in parentheses

Table I.
Means, standard deviations and correlations

	New product performance					
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Manufacturing industry	0.31	0.23	0.12	0.16	0.18	0.12
Technology industry	0.47***	0.48***	0.30**	0.33**	0.28**	0.24*
Firm age	0.09	0.08	0.18	0.02	0.11	0.07
Number of employees	0.10	0.05	0.03	0.02	−0.01	−0.02
Organizational formalization (*H1*)		0.35***		1.17**		0.84**
Organizational decentralization			2.83****		2.29****	1.57**
Organizational decentralization^2 (*H2*)			−2.73****		−3.11****	−2.18**
Market-oriented strategy				1.36***		0.99**
Technology-oriented strategy					−0.66	−0.36
Organizational formalization × Market-oriented strategy (*H3*)				−1.67***		−1.30*
Organizational decentralization × Technology-oriented strategy (*H4*)					1.41**	0.89
Model statistics						
ANOVA F	3.03*	4.87***	6.35***	6.07***	6.62***	5.63***
R^2	0.09	0.20	0.29	0.31	0.36	0.39
ΔR^2 from Model 1		0.11	0.20	0.22	0.27	0.30

Notes: $n = 95$ (two-tailed test). *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$; ****$p < 0.001$

Table II.
Results of hierarchal regression analyses for new product performance

As anticipated, industry exhibited significantly positive effects across the new product performance variables. The technology industry leaded to superior new product performance, as was consistent with the idea that the technology industry encouraged new product development activities (Hitt and Ireland, 1985). Model 2 captured the direct effect of organizational formalization on new product performance. This model was significant at the $p < 0.001$ level ($F = 4.87$, $R^2 = 0.20$) and explained an additional 11 percent of variance over what the control variables alone explain. The coefficient for organizational formalization was positive and significant ($p < 0.01$), indicating that firms would achieve a higher level of new product performance if they could make the organizational formalization more efficiently and effectively. Accordingly, *H1*, which stated that the organizational formalization has a positive relationship with new product performance, is supported.

We examined the inverse U-shaped relationship by adding the linear term and the squared term of organizational decentralization in Model 3. Models 3 included the control variables, the linear term and the squared term of organizational decentralization at the $p < 0.001$ level ($F = 6.35$, $R^2 = 0.29$) and explained an additional 20 percent of variance over what the control variables alone explained. In Model 3, the coefficient for the linear term of organizational decentralization was positive and significant ($p < 0.001$), while its square term was negative and significant ($p < 0.001$), indicating that firms would achieve a higher level of new product performance if they chose an appropriate level of organizational decentralization. Therefore, the results strongly supported *H2* regarding the inverse U-shaped relationship between organizational decentralization and new product performance.

Next, we tested *H3* and *H4* by adding the interaction term of organizational structure and strategic orientation in Models 4 and 5, respectively. *H3* predicted that market-oriented strategy would negatively moderate the relationship between organizational formalization and new product performance. Models 4 included the control variables, the independent variable of organizational formalization, the proposed moderator of market-oriented strategy and the interaction term of organizational formalization with market-oriented strategy. The model was significant at the $p < 0.001$ level ($F = 6.07$, $R^2 = 0.31$) and explained an additional 22 percent of variance over what the control variables alone explained. The coefficient of the interaction term between organizational formalization and strategic orientation in Model 4 was negatively signed and significant at the $p < 0.01$ level. The result confirms the prediction of *H3* that the positive relationship between organizational formalization and new product performance would be negatively moderated by market-oriented strategy. Thus, *H3* is supported.

To help provide a clearer understanding of the implications of the interaction terms of organizational formalization and strategic orientation for new product performance in our regression models, we followed the methods of Aiken and West (1991) to plot the trend showing the relationship between organizational formalization and new product performance at both high and low levels of market-oriented strategy. We defined the high- and low-level of market-oriented strategy based on one standard deviation below and above the mean, as the range for the moderator variables. Figure 2 displayed the form of the interaction effects of organizational formalization with market-oriented strategy on new product performance. The plots showed that organizational formalization was negatively related to the new product performance in implementing high levels of market-oriented strategies, while low levels of market-oriented strategies ameliorated the effects of organizational formalization on new product performance. In other words, high levels of market-oriented strategies reversed the positive "main effect" of organizational formalization influence on new product performance ($\beta = -1.67$, $p < 0.01$). Accordingly, organizational formalization seemed to have an asymmetric impact upon new product performance depending on the levels of market-oriented strategies in the dyad. More specifically, an interaction between organizational formalization and the market-oriented strategies was such that the levels of organizational formalization with low market-oriented

strategies was more positively associated with new product performance than formalization with high market-oriented strategies, informalization with high market-oriented strategies was associated with higher new product performance than informalization with low market-oriented strategies and formalization with high market-oriented strategies was associated with lower new product performance than formalization with low market-oriented strategies. Therefore, Figure 2 provides further support for *H3*.

In addition, *H4* was tested by adding the interaction term of organizational decentralization with technology-oriented strategy in Model 5. Model 5 includes the control variables, the linear term and the square term of organizational decentralization, the moderator of technology-oriented strategy and the interaction term of organizational decentralization with technology-oriented strategy. The model was significant at the $p < 0.001$ level ($F = 6.62$, $R^2 = 0.36$) and explained an additional 27 percent of variance over what the control variables alone explained. The coefficient of interaction terms for organizational decentralization with technology-oriented strategy was significant and positive ($p < 0.05$), suggesting that the reversed-U relationship between organizational decentralization and new product performance would be positively moderated by technology-oriented strategy. Thus this estimation results support *H4*.

Drawing on the moderating effect in Model 5, we constructed a three-dimension diagram, Figure 3, to illustrate the inverse U-shaped relationship between the organizational decentralization and new product performance under different contexts of technology-oriented strategy. Figure 3 depicts a curvilinear relationship that new product performance increases

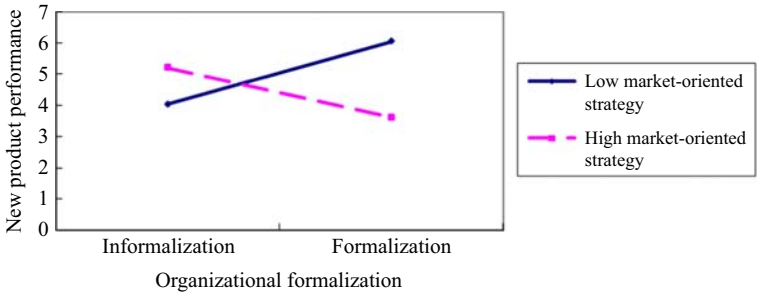

Figure 2.
Interaction graph of organizational formalization with market-oriented strategy on new product performance

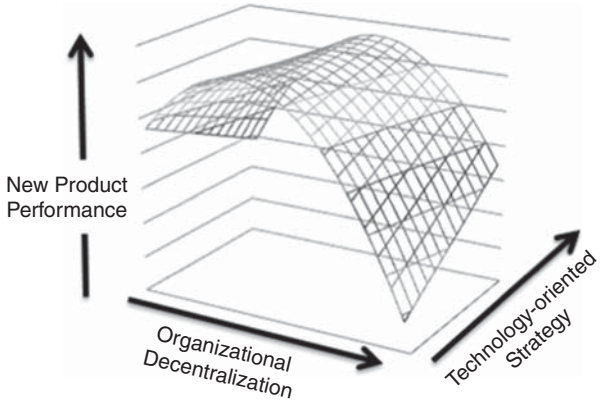

Figure 3.
The moderating effect of technology-oriented strategy on the curvilinear relationship between organizational decentralization and new product performance: a three-dimensional graph

initially and then decreases as organizational decentralization increases. An optimal level of the organizational decentralization would result in the best new product performance under a given level of technology-oriented strategy. As the level of technology-oriented strategy increases, the optimal level of organizational decentralization moves toward the right side. Also, as firms employed a higher level of technology-oriented strategy, the arc of organizational decentralization becomes steeper before the peak and becomes flatter after the peak. This result further supports *H4* regarding the positive moderating effect of technology-oriented strategy on the relationship between organizational decentralization and on new product performance.

5. Discussion and conclusion

This study investigates the effects of organizational structure and strategic orientation on new product performance. The empirical results provide support to the proposed research framework and hypotheses. The major findings and the implications are discussed as follows. First, the results provide empirical evidence to connect the positive relationship between formalization and new product performance. The evidence suggests that firms should know that new product development is chaotic and needs formalization. Our study examines the contingent moderator of market orientation. Consistent with our hypothesis, the positive effect of formalization on new product performance is strong under condition of a lower level of market orientation. This finding indicates that highly market-oriented strategies would benefit from less formalization to develop the market-sensing and customer-linking capabilities that enhance new product performance.

Second, hierarchical regression analysis indicates an inverse U-shaped relationship between decentralization and new product performance. The findings indicate an optimal level of decentralization for new product performance. Below that level, increased decentralization would enhance new product performance. At the same time, new product performance would decline down as decentralization exceeds the optimal level. The evidence suggests that new product development projects should not be too decentralized or too centralized. Instead, an optimal level of decentralization would allow firms to achieve better new product performance due to the reconciliation of positive and negative forces.

The managerial implications of these results are that managers need to know that there are two governing forces in organizational decentralization. A decentralized structure is beneficial to new product performance because of increased delegation of authority, flexibility, idea generation and knowledge sharing. A centralized structure avoids the detrimental effects of coordination and communication costs on new product performance. Therefore, managers should understand that organizational decentralization should be carefully defined to balance the two governing forces.

Finally, the results of hierarchal regression analysis indicate that technology orientation moderates the relationship between decentralization and new product performance. A technology-oriented strategy is more beneficial to new product performance when firms adopt a higher degree of decentralization while firms would get a better improvement effect on new product outcome through a less technology-oriented strategy when they adopt a centralization approach. A technology-oriented strategy can reallocate more resources to R&D and encourage more innovative ideas. These features can be amplified under a decentralized structure which also encourages more idea-sharing and respect for everyone's opinions. Similarly, the shortcomings of a technology-oriented strategy like the lack of customer voice and technological arrogance would be amplified again under a centralized structure. Therefore, it is better not to adopt a technology-oriented strategy under a centralization context.

Although a technology-oriented strategy combined with the decentralized structure can have a beneficial effect on new product performance, firms should understand that there is still an inverse U-shaped relationship between decentralization and new product performance.

Accordingly, an overly decentralized mechanism would make the technology so diversified that it would lose sight of product performance.

Our results shed some light on the effect of organizational structure on new product performance under different contexts of strategic orientation. At the same time, it has several limitations. There are several possible directions for further research. First, this study is based on self-reported data from the same informant, which may introduce the possibility of common method variance. To detect the presence of this bias, previous studies recommend examining the items used to measure the different constructs for semantic overlap (Podsakoff and Organ, 1986; Sethi and Iqbal, 2008). In our study, we have not found an overlap among the items in different measures. To detect the presence of common method bias, we conducted Harman's one-factor test (Podasakoff *et al.*, 2003). The results of principal component analysis without rotation indicated that variables do not form a single higher-order factor, which suggests that common method bias in this study is not a serious cause for concern. Second, the small sample size and the Chinese context of the study may limit the general applicability of the findings. Future studies should use larger sample sizes and replicate our results in countries with different cultural contexts to create more confidence in the results. Third, this study introduces only strategic orientation as the moderator of organizational structure–new product performance relationship. Broader types of strategic orientation factors, such as entrepreneurial orientation, learning orientation, international growth orientation (Jantunen *et al.*, 2008), may also affect the relationship. Future research can explore how these factors contribute to strengthening or weakening the impact of organizational structure on new product performance. Similarly, the same research framework can also test the other dependent variable such as product exploration and exploitation, since some scholars had different views of organizational structure on product innovation capability (Gupta *et al.*, 1997; Menguc and Auh, 2010; Pertusa-Ortega *et al.*, 2010). Finally, there are multiple classifications of organizational structure and strategic orientation. We suggest there may be interesting relationships between mechanistic/organic organization design and market/entrepreneurship orientation on new product performance. Finding a different structure strategy math to achieve congruence in organization context would also be worthwhile.

Note

1. Factor loadings for new product performance was as follows: profit, 0.87; sales, 0.91; return on investment, 0.88; market share, 0.76; customer satisfaction, 0.86; and timing of market, 0.75.

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