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Flying or dying? Organizational change, customer participation, and innovation ambidexterity in emerging economies

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Abstract In emerging economies, organizational change is both a difficult challenge and a common phenomenon for high-tech firms. Change can enhance adaptability and leverage knowledge based on dynamic capability perspective, but it can also increase coordination costs and—according to the organizational inertia perspective—prompt conflict. Existing findings about the effect of organizational change on firm performance are inconsistent. Accordingly, this survey study of 213 firms in the Chinese high-tech industry investigates the curvilinear and differential effects of technical and administrative organizational change, as moderated by customer participation and innovation ambidexterity. The results reveal that the effects of technical and administrative change are both U-shaped. At a low level of change, increasing technical or administrative change hinders firm performance, but as the levels increase beyond a critical point, the effect of change becomes positive. Although customer participation strengthens the effect of technical change on firm performance, both customer participation and innovation ambidexterity attenuate the effect of administrative change on firm performance.

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In emerging economies (e.g., China), as elsewhere, change is constant (Hoskisson, Eden, Lau, & Wright, 2000). Firms face unstable markets, turbulent technology, and unforeseen transitions of social and economic systems (Zhan & Chen, 2008; Zhou, Tse, & Li, 2006). To adapt to these changing environments, firms alter their organizations by introducing new technologies, administrations, and processes (Battilana & Casciaro, 2013; Zhou et al., 2006). Organizational change offers a popular way to satisfy customer needs and gain competitive advantages (Armenakis & Harris, 2009; Ye, Datelina, & Jagdip, 2007). For example, in 2009, to respond to rapid growth in its network traffic, Huawei, the largest telephone-network equipment maker in China, launched the world's first 100G end-to-end solutions.

However, organizational change also is difficult: Approximately 70% of all change initiatives fail (Beer & Nohria, 2000). Therefore, organizational change remains an issue of great strategic importance, especially in terms of its impact on firm performance. Can organizational change enhance firm performance? Do firms that change fly—or do they die?

Existing findings about the effect of organizational change on firm performance are inconsistent. Some research indicates that organizational change enhances firm performance (Judge, Naoumova, & Douglas, 2009; Zhou et al., 2006); other studies find negative effects (Graham & Richards, 1979; Kraatz & Zajac, 2001; Naranjo-Gil, Hartmann, & Maas, 2008) or no impact (Kelly & Amburgey, 1991; Wischnevsky, 2004; Zajac & Shortell, 1989). Table 1 contains a review of prior studies related to the performance impacts of organizational change. The inconsistent findings may be the result, at least in part, of the potentially nonlinear relationship between organizational change and firm performance (Zhang & Rajagopalan, 2010). Moreover, prior studies devote only limited attention to the various aspects of organizational change, framing it as a single-dimensional strategy, with the notable exception of Zhou et al. (2006). By following their approach, such that they differentiate organizational change into *technical change* and *administrative change* forms, we seek to advance extant research and propose that the effects of such changes on firm performance are both curvilinear and differential across conditions.

Technical change relates to basic work activities, including products, services, and processes. Administrative change instead refers to organizational structures, administrative processes, and management systems (Tsoukas, 1996; Zhou et al., 2006). Accordingly, we examine the differential effects of technical and administrative change, with the recognition that—according to the dynamic capability perspective—such changes not only enhance adaptability and enable firms to leverage knowledge (Amburgey, Kelly, & Barnett, 1993; Leana & Barry, 2000; Teece, 2007) but also increase coordination costs and—according to an organizational inertia perspective—prompt organizational conflict (Greenwood & Hinings, 2006; Hannan & Freeman, 1984; Leana & Barry, 2000). Thus, we assume that the effects of technical change and administrative change on firm performance are U-shaped and that customer participation and innovation ambidexterity act as moderators of these links. According to dynamic capability theory, market information is one of a firm's most significant resources, and information integration, learning, and reconfiguration are essential organizational abilities (Teece, 2007; Teece, Pisano, & Shuen, 1997). *Customer*

participation is a critical capability, such that customers provide external market information and channels of communication with outside sources (Fang, 2008). Moreover, to integrate and reconfigure information, firms must make trade-offs between the exploitation of their existing resources and the exploration of new resources (Levinthal & March, 1993). *Innovation ambidexterity* is the ability to implement both explorative and exploitative innovation simultaneously (Andriopoulos & Lewis, 2009; Jansen, van den Bosch, & Volberda, 2005). We consider whether and how customer participation and innovation ambidexterity might moderate the effects of technical change and administrative change on firm performance (Fig. 1).

With a survey of both senior and middle managers of 213 firms in the Chinese high-tech industry, we affirm that the effects of both technical and administrative change are U-shaped. At low levels of change, increasing technical or administrative change hinders firm performance, but as levels increase beyond critical points, the effect of change becomes positive. Moreover, customer participation strengthens the U-shaped relationship between technical change and firm performance, but customer participation and innovation ambidexterity both attenuate the U-shaped relationship between administrative change and firm performance. Relative to the studies in Table 1, our findings contribute to organizational change research by providing new insights into the nonlinear effects of organizational change. We also enrich understanding of how customer participation and innovation ambidexterity strengthen and attenuate these nonlinear effects, according to different types of organizational change in emerging economies.

The remainder of this article proceeds as follows: First, we advance a research framework to investigate the effects of technical and administrative change on firm performance, according to dynamic capability and organizational inertia theories. Within this framework, we address how customer participation and innovation ambidexterity moderate the focal effects. Second, we describe our empirical context (i.e., Chinese high-tech firms), detail our data collection procedures, and present our data analysis. Third, we conclude with a discussion of the implications, limitations, and future research directions.

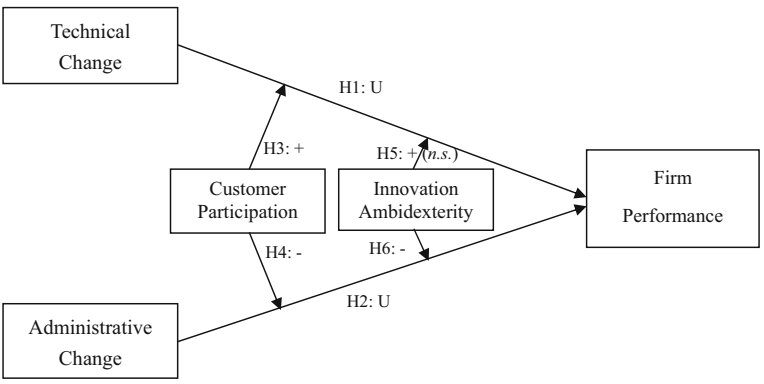

Fig. 1 Research framework

Theoretical background and hypotheses development

Technical change and administrative change

Organizational change can occur in various ways. Firms may introduce new measures, such as technologies, administrations, and processes. Following Greve (1998) and Zhou et al. (2006), we take a continuous view of organizational change, rather than focusing on singular change episodes or events (e.g., CEO succession, change of product niche). Most studies in Table 1 do not differentiate the various aspects of organizational change. In emerging economies though, dynamic and unstable environments generate pressures on firms to change by adopting new technologies and administrative systems (Child & Tse, 2001; Keister, 2002). Therefore, in line with Zhou et al. (2006), we classify organizational change into the two dimensions of technical change and administrative change.

Technical change pertains to "products, services, and production process technology; it is related to basic work activities and can concern products, service or process" (Zhou et al., 2006: 250). It results from implementing a variety of new measures, including new ways to develop products, procedures to increase operational efficiency, methods to achieve technological innovation, systems to update production equipment, or means to enhance product quality (Damanpour, 1991), such as when Huawei launched 100G end-to-end network solutions and smart mobile devices. Administrative change involves the organizational structure and administration process and is related directly to firms' management systems, in departments such as finance, personnel training and management, and compensation (Tsoukas, 1996; Zhou et al., 2006). For example, to improve its administrative efficiency and implement product innovations more flexibly, Huawei converted its organizational structure from a line to a matrix format. In this new structure, a distinct product development team, composed of representatives from R&D, marketing, and finance, was responsible for each product. On the basis of this approach, we propose an integrative framework of the nonlinear and moderating effects of two changes on firm performance (see in Fig. 1).

Dynamic capability and organizational inertia perspectives of organizational change

On the basis of dynamic capability and organizational inertia theories, we identify both positive and negative mechanisms through which organizational change might affect firm performance (Table 2). On the one hand, dynamic capability generates positive mechanisms; Teece et al. (1997) defined dynamic capability as a firm's ability to integrate, build, and reconfigure internal and external competencies to address changing environments. Organizational change is one of the most influential dynamic capabilities, in that it helps firms adapt to external threats and build new capabilities, which lead to competitive advantages (Judge & Elenkov, 2005). On the other hand, Hannan and Freeman (1984) argued that organizational inertia, or stable resources and routines that limit a firm's adaptation to changing environments, can create internal resistance to organizational changes to the status quo (Gilbert, 2005).

Table 1 Literature review related to the effects of organizational change

Studies	How to define or measure organizational change	Whether tested technical change	Whether tested administrative change	Moderators	Research context	Main findings
Graham & Richards, 1979	Changes in presidents, boards of directors, and strategies				Developed economy-USA	Change decreases firm performance.
Kelly & Amburgey, 1991	Changes of the product mix				Developed economy-USA	No effect.
Haveman, 1992	Continuous view. Movement away from domain into new markets				Developed economy-USA	Most changes enhance financial performance and diminish failure rates.
Amburgey et al., 1993	Changes in publication content and frequency				Developed economy-Finland	Change increases firm failure.
Dobrev, Kim, & Carroll, 2003	Change in product niche and market center				Developed economy-USA	Change increases firm failure.
Wischnevsky, 2004	A dichotomous variable, whenever changes in strategy, structure, and power distribution were observed				Developed economy-USA	No effect.
Judge et al., 2009	Continuous view. Capacity of organizational change				Emerging economy-Russia	Organizational capacity for change increases firm performance.
Cui, Calantone, & Griffith, 2011	Changes in partnering and resource deployment				Developed economy-USA	Changes increase firm performance.
Zajac, Kraatz, & Bresser, 2000	Change in residential mortgage lending			Cost of funds, interest rate	Developed economy-USA	Change increases return on assets. Moderators attenuate this effect.
Kraatz & Zajac, 2001	Percentage in non-liberal arts fields			Organizational Resources	Developed economy-USA	Change decreases firm performance. Greater resources toward change tend to have beneficial effect on performance.
Fiss & Zajac, 2006	Structural changes in three governance practices		Yes		Developed economy-German	Change increases total investment returns.

Table 1 (continued)

Studies	How to define or measure organizational change	Whether tested technical change	Whether tested administrative change	Moderators	Research context	Main findings
Quigley & Hambrick, 2012	Resource reallocations, acquisitions and divestitures, and top management team (TMT) staffing		Yes		Developed economy-USA	Resource change increases return on assets, but TMT change has no effect.
Klarner & Raisch, 2013	Changes in scope of operations and along diversification-refocusing dimension	Yes			Developed economy-European	Regular change increases long-term performance.
Zhou et al., 2006	Technical- and administrative-based changes	Yes	Yes	Participative culture	Emerging economy-China	Technical change enhances performance, but administrative change has no effect.
This paper	Technical- and administrative-based changes	Yes	Yes	Customer participation; Innovation ambidexterity	Emerging economy-China	Effects of two changes are U-shaped. Customer participation strengthens effect of technical change. Participation and ambidexterity attenuate the effect of administrative change.

Table 2 Mechanisms

	Positive mechanism: Dynamic capability perspective		Negative mechanism: Organizational inertia perspective		Hypotheses: Net effect on firm performance	Empirical finding
	Market adaptability	Leverage knowledge	Organizational conflict	Coordination cost		
Main effect						
Technical change	+	+	−		H 1: U	U
Administrative change	+		−	−	H 2: U	U
Moderating effect of customer participation on						
Technical change	++	++	−		H 3: +	+
Administrative change			−	−	H 4: −	−
Moderating effect of ambidexterity on						
Technical change	−	++			H 5: +	n.s.
Administrative change	−		−		H 6: −	−

For the mechanisms of main effect, positive (negative) signs represent positive (negative) impacts

For the mechanisms of moderating effects, two positive (negative) signs represent the strengthening of related positive (negative) impacts. One negative sign represents the attenuation of related positive and negative impacts.

Positive mechanisms: Dynamic capability perspective

We consider two positive mechanisms based on the dynamic capability perspective. First, technical change can help firms leverage knowledge. According to a dynamic capability perspective, competitive advantages result from an effective configuration and integration of external and internal knowledge. In the process of technical change, firms pay close attention to technological progress and customer needs, thereby absorbing knowledge in a timely fashion (Han, Kim, & Srivastava, 1998) and changing their knowledge structures, operational processes, and product lines. Moreover, change means abandoning old practices and setting up new ones. The establishment of new practices entails a process of learning (Amburgey et al., 1993), through which firms can improve their ability to recognize change paths and leverage their knowledge of new technology (Levinthal & March, 1993). Yet administrative change should have no notable impact on a firm's capability to leverage knowledge, because it pertains to changes in business processes and structures rather than knowledge structures (Fiss & Zajac, 2006). This type of change does not drive firms to engage in activities such as absorbing or transferring knowledge. It relates only indirectly to fundamental work activities and instead relates more directly to management systems (Damanpour, 1991).

Second, technical and administrative changes both should make organizations more adaptable to markets and environments (Leana & Barry, 2000; Staber & Sydow, 2002) and more flexible, thereby contributing to performance and long-term survival, especially if those firms operate in the turbulent, changing markets of emerging economies, in which internal and external knowledge are changeable. Market adaptability is critical for firms to acquire and integrate information (Wang, Huang, & Shou, 2015). Although technical change may smooth out market uncertainties in customer demand (Zhou et al., 2006), administrative change allows for new organizational structures that better satisfy turbulent markets (Damanpour & Evan, 1984). Thus, both technical and administrative change should enable firms to adapt to complex and dynamic environments.

Negative mechanisms: Organizational inertia perspective

We also consider two negative mechanisms, based on the organizational inertia perspective. First, administrative change likely increases coordination costs. As Dahl (2011) argued, organizational change is difficult, complicated, risky, and costly. When firms initiate administrative changes, they devote resources to the new operational processes and management systems required to alter organizational structures. As functional departments coordinate and disseminate information internally, resources become depleted, thereby increasing firms' costs (Dahl, 2011; Oreg, 2003). Moreover, our study context involves high-tech firms, in which technical-based organizational change represents an industry norm, so it seems unlikely that major coordination would arise. However, technical change is unlikely to increase coordination costs and do not increase demands for management efficiency among functional departments (Wang et al., 2015). Technical change directly relates to basic work activities (e.g., production, new product development), not to organizational structures and management systems (Zhou et al., 2006).

Second, technical and administrative change both can trigger organizational conflicts. To be successful, change must overcome organizational inertia (Gilbert, 2005) and break away from existing routines (Battilana, 2011; Greenwood & Hinings, 2006). During the

organizational change process, new elements, technologies, and structures get integrated, disrupting the stability of firms and inducing conflict in resource allocations and routines (Gilbert, 2005; Hannan & Freeman, 1984). Conflicts are negative in this case; they increase employees' psychological pressures and turnover intentions while also decreasing satisfaction and productivity levels (Baron, Hannan, & Burton, 2001).

Effect of technical change on firm performance

As a technical change begins, the negative effects exert more impact than the positive effects. At this low level of change, firms need to alter their existing technologies, learn new skills, reallocate resources, and adapt to new environments (Zhang & Rajagopalan, 2010). Together, these actions tend to spark greater organizational conflict. Thus, firm performance suffers.

However, when the change level reaches a certain point, the positive effects (e.g., greater adaptability, leveraging of knowledge) begin to surpass the negative effects. Conflict tends to abate through the process of organizational learning (Amburgey et al., 1993). Organizations gain more dynamic capabilities, adapt better to markets, leverage more knowledge, and exhibit stronger performance (Zhang & Rajagopalan, 2010). As the level of technical change increases, firm performance improves.

Hypothesis 1 The relationship between technical change and firm performance is U-shaped, such that at low levels of technical change, increasing change harms firm performance, but as change increases beyond a critical level, the effect of technical change becomes positive.

Effect of administrative change on firm performance

When administrative change is minimal but starting to increase, the negative effects exert more impact than the positive effects. At this low level, firms need to alter their existing administrative routines and adapt to new transitions (Gilbert, 2005). These actions increase firms' coordination costs and generate organizational conflict. Meanwhile, employees of inertial organizations resist change, thereby reducing the company's overall efficiency (Dahl, 2011).

After the change reaches a certain degree, the expanding positive effects (i.e., greater market adaptability) surpass the negative effects. With high levels of administrative change, firms re-engineer their business processes and structures (Fiss & Zajac, 2006), such that they can adapt to rapidly changing markets. Moreover, conflict decreases because the radical change establishes new organizational structures and routines (Hannan & Freeman, 1984). Thus, as the level of administrative change increases, firm performance improves.

Hypothesis 2 The relationship between administrative change and firm performance is U-shaped, such that at low levels of administrative change, increasing change harms performance, but as change increases beyond a critical level, the effect of administrative change becomes positive.

Moderating role of customer participation

Competitive advantages depend on firms' abilities to learn and integrate market information. Customer participation enables firms to communicate with outside markets and obtain customer insights, in the form of information provided by customers to improve new products or services (Cermak, File, & Prince, 1994; Fang, 2008; Kelley, Donnelly, James, & Skinner, 1990), and undertake co-development efforts, such that customers engage in design, R&D, and manufacturing processes and co-create new products or services with firms (Fang, 2008; Fang, Palmatier, & Evans, 2008). Customer participation thus equips firms with abundant external resources.

Although customer participation can strengthen the positive impacts of technical change, it can attenuate the negative impact of technical change too (Table 2). When customers participate in production and delivery processes, external knowledge transfers to the firms, through their interactions with customers. That is, firms acquire and accumulate more valuable knowledge and experience. As Vargo and Lusch (2004) noted, customer participation is important for its "information transferring" outcomes. Through interactions with customers, firms can more easily absorb external information and effectively leverage knowledge of processes, structures, and production methods. Customer participation also grants firms a better understanding of customer needs and market trends, such that they are more capable of enhancing their own adaptability (Fang et al., 2008). In addition, new technology can disrupt firm stability, leading to conflict over resource allocation and routines (Gilbert, 2005). However, during their interactions with customers, firms with market orientations can gain external knowledge and information that mitigates this organizational conflict, due to the process of external learning (Im & Workman, 2004).

Moreover, customer participation can strengthen the negative impacts of administrative change. During interactions with customers, firms grow more aware of external customers and more customer oriented (Day, 1994). Although they avoid wasting resources on activities other than customer-related marketing, firms also may become myopic in their focus on customers (Cermak et al., 1994; Fang, 2008). During the process of administrative change, coordination costs increase, and the efficiency of information dissemination among functional departments decreases, because firms are oriented solely externally (Day, 1994). Moreover, employees from other departments (e.g., R&D) are unable to understand the purpose and significance of administrative change when they interact with external customers, such that they resist administrative change, so organizational conflict becomes more likely (Han et al., 1998). Thus, we propose:

Hypothesis 3 Customer participation positively moderates the relationship between technical change and firm performance.

Hypothesis 4 Customer participation negatively moderates the relationship between administrative change and firm performance.

Moderating role of innovation ambidexterity

To integrate knowledge, firms must make trade-offs between exploitation and exploration (Levinthal & March, 1993; Raisch & Birkinshaw, 2008). *Innovation*

ambidexterity implies an ability to exploit and explore simultaneously (Jansen et al., 2005). March (1991) indicated that the essence of exploitation is the refinement and extension of existing competencies and paradigms, whereas the essence of exploration is experimenting with new competencies and paradigms. Exploration is the process of searching for and pursuing new knowledge and skills, which is risky but conducive to a firm's long-term returns. In contrast, exploitation means that a firm is likely to use existing knowledge and develop incremental innovations to satisfy the needs of existing markets. A high level of ambidexterity implies a balance between exploration and exploitation; a low level of ambidexterity indicates that the firm focuses on either exploration or exploitation (Simsek, 2009).

Innovation ambidexterity in turn is a double-edged sword. Although it strengthens the ability of firms to leverage knowledge, it also attenuates their ability to adapt. In transitional and emerging economies (e.g., China), the external environment is extremely complex and changeable (Zhou et al., 2006). Compared with other industries, the high-tech industry also features more innovative activities (Peng & Heath, 1996). Ambidextrous firms pursue both long- and short-term benefits, through both exploratory and exploitive innovations, but in doing so, they become less adaptable and profitable (Raisch & Birkinshaw, 2008). Venkatraman, Lee, and Iyer (2007) found that temporal cycling between exploitation and exploration (which is different from ambidexterity) has a positive effect on firm performance, and Jansen, van den Bosch, and Volberda (2006) revealed that pursuing simultaneous exploitation and exploration is not effective in dynamic, changing environments, because firms with high ambidexterity tend to be less flexible and adaptable (Jansen et al., 2005). However, high levels of innovation ambidexterity require redesigns of organizations' production methods and technology structures (Simsek, 2009). Such firms pay close attention to technological progress and can leverage their internal and external knowledge at the right time (Han et al., 1998).

Innovation ambidexterity also may strengthen the negative impacts of the organizational conflicts generated by administrative change. Trying to balance two innovation strategies demands diverse tasks and restricts various forms of knowledge (Carmeli & Halevi, 2009). Managers' demands for ambidexterity also can create a challenging atmosphere for employees, who then suffer from greater organizational inertia. In the face of administrative changes, organizational conflicts are more likely, because any existing balance gets disrupted (Kleinschmidt & Cooper, 1991). Thus, we propose the following hypotheses (note that Hypothesis 5 is indeterminate though, because ambidexterity both strengthens and attenuates the positive impacts of technical change):

Hypothesis 5 Innovation ambidexterity positively moderates the relationship between technical change and firm performance.

Hypothesis 6 Innovation ambidexterity negatively moderates the relationship between administrative change and firm performance.

Methods

Data collection

To test the hypotheses, we investigated firms in Chinese high-tech industries (e.g., information technology, electronics, telecommunication), for several reasons. First, China is the largest and fastest-growing emerging economy; in this changeable environment, organizational change is common. Second, the high-tech industry is one of most important segments in the world economy. Third, in response to the unstable market and institutional environment in China, high-tech firms often change their organizations to adapt to new technologies and new management systems. This organizational change setting thus provides an ideal context for studying whether and when organizational change affects firm performance.

We randomly chose 600 high-tech firms from the database of a leading survey company's panel. The firms are located in Guangdong and Shanghai. To reduce common method bias, we surveyed one senior manager (of at least vice-president rank) and one middle manager (marketing or R&D department) for each firm. Representatives from the survey company visited the firms, conducted face-to-face interviews, and filled out questionnaires targeted to senior and middle managers. A total of 382 firms agreed to participate, and we obtained feedback from both informants for 221 firms. After excluding incomplete questionnaires, our final sample included 213 firms. The senior managers provided information about firm performance, organizational change, firm size, firm age, and firm ownership. The middle managers supplied information about customer participation, exploratory and exploitative innovations, technological turbulence, and market growth.

Measures

The questionnaire was first developed in English. Two independent research assistants translated the questionnaire into Chinese, then back-translated it into English to check content clarity. The Appendix provides the measurement items and validity evaluations.

To measure firm performance, we followed Zhou, Yim, and Tse (2005). Four items assess return on investments, profit margin, sales growth rate, and market share relative to major competitors. Measurements of organizational change, distinguished as technical and administrative changes, come from Zhou et al. (2006). Each dimension includes five items. For the measure of customer participation, we used six items from Fang (2008) to assess information offering and customer codevelopment. In our empirical context, because information offering and customer co-development are highly correlated (r = .873, p < .05), we combined the two scales. Moreover, in line with previous research, we combined items pertaining to exploratory and exploitative innovation to calculate innovation ambidexterity. First, following Atuahene-Gima (2005), we measured exploration and exploitation with five items. Second, to measure ambidexterity, we applied a subtraction model, such that we calculated 7 minus the absolute value of exploration subtracted from exploitation. The smaller the absolute value, the greater the balance between the two forms of innovations.

To control for extraneous effects on firm performance, we also controlled for several variables. We measured the intensity of firm innovation as the average of exploration and

exploitation, firm size as the number of employees, and firm age as the number of years of operation of the firm. We designated an ownership dummy variable, to indicate state-owned firms, and measured market growth by three items from Im and Workman (2004). Finally, we adopted a three-item technological turbulence measure from Jaworski and Kohli (1993).

Common method bias

Common method bias, or co-variation between potential variables and extrinsic variables, results from using the same method, data source (or subjects), or survey context. This variance may be a systematic error, in which case it leads to confusing or misleading effects. To reduce this threat, we surveyed one senior manager and one middle manager from each firm. In addition, we applied Harman's one-factor test and loaded all indicators into an exploratory factor analysis. No single factor explained more than 40% of the total variance. Thus, common method bias was not a serious concern (Podsakoff, Scott, Lee, & Podsakoff, 2003).

Reliability and validity

The Appendix indicates that all constructs exhibited high reliability. The Cronbach's alpha values ranged from .702 to .938, all above the .70 benchmark. Average variances extracted (AVE) and composite reliabilities (CR) were all greater than .5. We executed a confirmatory factor analysis to assess construct validity. The analysis offered acceptable fit indices (see the Appendix). All factor loadings were large enough and significant at the .01 level. The fit indexes also reflected the good convergent validity and reliability of our model (goodness-of-fit index [GFI] = .92, comparative fit index [CFI] = .91, incremental fit index [IFI] = .91, root mean square error [RMSE] = .05). In terms of discriminant validity, the tests of the chi-square difference for all constructs in pairs checked whether the freely estimated, unconstrained model was better than a restricted model. All chi-square differences were significant at .01, in support of discriminant validity (Anderson & Gerbing, 1988).

Analysis and results

The correlation matrix and descriptive statistics are in Table 3.

To test our six hypotheses, we employed a stepwise regression (Aiken & West, 1991). The models are as follows:

$$\begin{aligned}
\text{Firm Performance}_i = {} & X'_i\beta + \varepsilon_i, \\
\text{Step 1 (Model 1)} = {} & \beta_0 + \beta_1 \text{Firm Size}_i + \beta_2 \text{Firm Age}_i + \beta_3 \text{Firm Ownership}_i + \beta_4 \text{Market Growth}_i \\
& + \beta_5 \text{Technological Turbulence}_i + \beta_6 \text{Innovation Intensity}_i + \beta_7 \text{CustomerParticipation}_i \\
& + \beta_8 \text{Innovation Ambidexterity}_i + \beta_9 \text{Technical Change}_i + \beta_{10} \text{Administrative Change}_i \\
\text{Step 2 (Model 2)} + {} & \beta_{11} \text{Technical Change}^2{}_i + \beta_{12} \text{Administrative Change}^2{}_i \\
\text{Step 3 (Model 3)} + {} & \beta_{13} \text{Technical Change}_i \times \text{Customer Participation}_i + \beta_{14} \text{Technical Change}^2{}_i \\
& \times \text{Customer Participation}_i + \beta_{15} \text{Administrative Change}_i \times \text{Customer Participation}_i \\
& + \beta_{16} \text{Administrative Change}^2{}_i \times \text{Customer Participation}_i + \beta_{17} \text{Technical Change}_i \\
& \times \text{Innovation Ambidexterity}_i + \beta_{18} \text{Technical Change}^2{}_i \times \text{Innovation Ambidexterity}_i \\
& + \beta_{19} \text{Administrative Change}_i \times \text{Innovation Ambidexterity}_i + \beta_{20} \text{Administrative Change}^2{}_i \\
& \times \text{Innovation Ambidexterity}_i
\end{aligned}$$

Table 3 Descriptive statistics and correlations

	Mean	SD	Correlation										
			1	2	3	4	5	6	7	8	9	10	11
1. Firm performance	5.81	.58	1										
2. Technical change	5.86	.60	.62	1									
3. Administrative change	4.68	1.43	−.21	−.11	1								
4. Customer participation	5.90	.73	.52	.50	−.17	1							
5. Innovation ambidexterity	5.69	.42	.33	.28	.01	.02	1						
6. Firm size	3.08	1.10	.05	−.04	.15	.03	.03	1					
7. Firm age	3.57	.61	.21	.22	−.19	.12	.08	.26	1				
8. Ownership	.17	.38	.11	.10	−.12	.12	.10	.26	.22	1			
9. Innovation intensity	5.96	.47	.68	.43	−.11	.58	.33	.02	.22	.13	1		
10. Market growth	5.87	.71	.64	.56	−.24	.59	.25	.08	.18	.14	.66	1	
11. Technological turbulence	5.99	.62	.49	.53	−.22	.53	.08	.10	.17	.16	.61	.63	1

$N = 213$. Both $r > .11$ and $r < -.11$ are significant at $p < .05$

To reduce potential multicollinearity, we standardized the independent variables, moderators, and control variables (Aiken & West, 1991). All variance inflation factors (VIFs) ranged from 1.28 to 4.53, suggesting no serious multicollinearity problems. Table 4 reports the data analysis results from the stepwise regression. Model 1 includes technical change, administrative change, customer participation, innovation ambidexterity, and the control variables. Model 2 contains the squared terms of technical and administrative change, and Model 3 includes the interactions of technical and administrative change and their squared term with customer participation and innovation ambidexterity.

In Model 2, the coefficients for technical change ($\beta = .121$, $p < .01$) and the squared term ($\beta = .088$, $p < .001$) are significant. In Model 3, the coefficients for technical change ($\beta = .088$, $p < .05$) and the squared term ($\beta = .066$, $p < .05$) are also significant. These results confirm H1, that is, that the relationship between technical change and performance is U-shaped. For administrative change, in Model 2, the squared term for administrative change ($\beta = .164$, $p < .001$) is significant. In Model 3, the coefficients for administrative change ($\beta = .077$, $p < .05$) and the squared term ($\beta = .156$, $p < .01$) are also significant. These results confirm H2; the relationship between administrative change and performance is U-shaped. Thus, enhancing technical or administrative change hinders performance at first, but improves it after a certain threshold. Although these effects on firm performance are all U-shaped, their patterns are different. In model 3, for technical change, the inflection point is $-.67\sigma$, and the green line in Fig. 2 is nearly an increasing line. For administrative change, the inflection point is $-.24\sigma$. The green lines in Figs. 3 and 4 are more similar U-shaped patterns.

We also predicted moderating roles of customer participation and innovation ambidexterity. For customer participation, the interaction between technical change and customer participation is significant and positive ($\beta = .084$, $p < .05$), but the interaction between the squared term of technical change and customer participation is not significant ($\beta = -.029$, $p > .05$), which supports H3. The interaction between

Table 4 Effects of organizational change, customer participation, and ambidexterity on firm performance

	Hypotheses	Model 1		Model 2		Model 3	
		Coefficient	S. E.	Coefficient	S. E.	Coefficient	S. E.
Main effects							
Technical change (TC)	H1 supported	.122	.037***	.121	.046**	.088	.051*
Technical change^2 (TC^2)				.088	.022***	.066	.031*
Administrative change (AC)	H2 supported	−.041	.033	.021	.037	.076	.042*
Administrative change^2 (AC^2)				.164	.046***	.156	.053**
Customer participation (CP)		.061	.035*	.067	.036*	.150	.165
Innovation ambidexterity (IA)		−.002	.036	.027	.028	.089	.074
Moderating effects							
TC × CP	H3 supported					.084	.045*
TC^2 × CP						−.029	.018
TC × IA	H5 not supported					.014	.028
TC^2 × IA						.011	.019
AC × CP	H4 supported					−.096	.050*
AC^2 × CP						.001	.041
AC × IA	H6 supported					− .010	.043
AC^2 × IA						− .084	.039*
Control variables							
Firm size		− .014	.032	− .007	.028	.004	.029
Firm age		.028	.035	.035	.029	.035	.028
Firm ownership		−.023	.075	−.018	.071	−.020	.071
Market growth		.117	.039**	.081	.032**	.088	.036**
Technological turbulence		−.062	.041	− .033	.036	− .003	.037
Innovation Intensity		.101	.052*	.047	.024*	.075	.044*
Intercept		5.885	.031***	5.633	.057***	5.617	.661***
N		213		213		213	
R^2		.365		.449		.515	
Incremental ΔR^2 (*F*-test)				.084*		.066*	

* $p < .05$, ** $p < .01$, *** $p < .001$

administrative change and customer participation is significant and negative ($\beta = -.096$, $p < .05$), but the interaction between the squared term of administrative change and customer participation is not significant ($\beta = .001$, $p > .05$). Therefore, H4 is supported.

For innovation ambidexterity, the interaction with technical change is insignificant ($\beta = .014$, $p > .05$). The interaction between the squared term of technical change and innovation ambidexterity is also insignificant ($\beta = .011$, $p > .05$). Therefore, H5 is not supported. As we noted, ambidexterity both strengthens and attenuates the positive impacts of technical change.

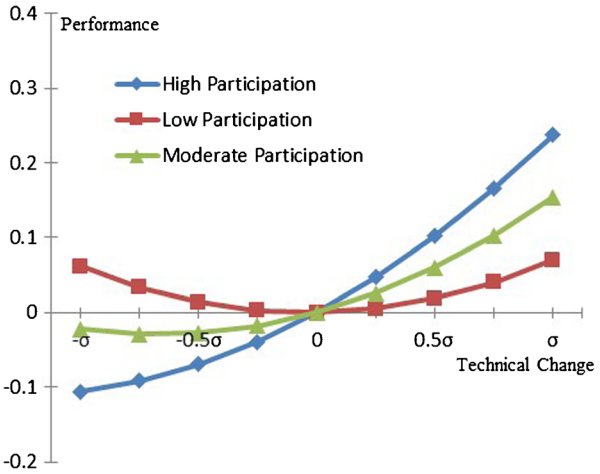

Fig. 2 Moderating effect of customer participation on technical change

Although the interaction between administrative change and innovation ambidexterity is not significant ($\beta = -.010$, $p > .05$), the interaction between the squared term of administrative change and innovation ambidexterity is significant and negative ($\beta = -.084$, $p < .05$), which supports H6.

To gain insights into the moderating effects of customer participation and ambidexterity, we plotted the relationship between organizational change and firm performance at high and low values of each moderator (customer participation and ambidexterity). Applying Aiken and West's (1991) simple slope tests, we decomposed the interaction terms. Specifically, we split customer participation (innovation ambidexterity) into high (one standard deviation above the mean) and low (one standard deviation below the mean) groups and estimated the effect of organizational change on firm performance at both levels. The slopes in Fig. 2 indicate that customer participation positively moderates the U-shaped relationship between technical change and firm performance. Figure 3 indicates that customer participation negatively moderates the U-shaped relationship between administrative change and firm performance. Figure 4 further

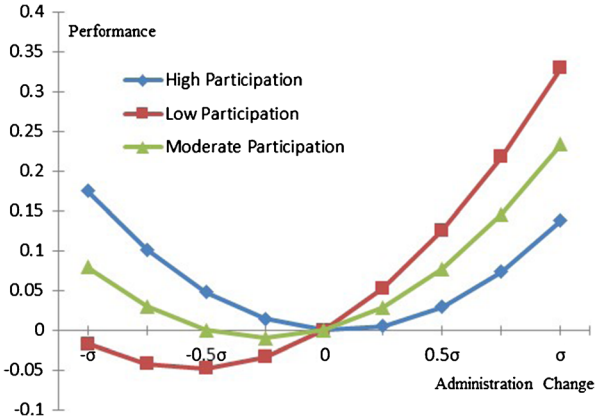

Fig. 3 Moderating effect of customer participation on administrative change

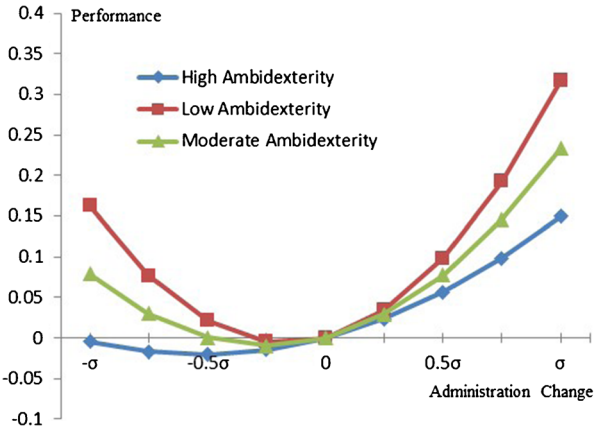

Fig. 4 Moderating effect of innovation ambidexterity on administrative change

indicates that innovation ambidexterity negatively moderates the U-shaped relationship between administrative change and firm performance.

Discussion

In emerging economies, organizational change, though difficult, has become a common phenomenon, especially among high-tech firms. Going beyond existing literature, we propose that the performance effects of technical and administrative change are not only curvilinear but also differential across various conditions. With a survey study of 213 high-tech firms in China, we find that the effects of technical and administrative change on firm performance are both U-shaped. Moreover, whereas customer participation strengthens the effect of technical change on firm performance, customer participation and innovation ambidexterity both attenuate the effect of administrative change on firm performance.

These findings contribute to organizational change literature by providing new insights into the nonlinear effects of organizational change and clarifying understanding of the roles of customer participation and innovation ambidexterity in emerging economies. First, this article offers an initial investigation of a nonlinear effect of organizational change in emerging economies. Prior studies of the relationship between organizational change and performance provide inconsistent findings (Table 1). Some research indicates that organizational change enhances firm performance; other studies find negative effects or no impact. These inconsistent findings may be due to the nonlinear effect of organizational change.

Second, we combine dynamic capability and organizational inertia theories. According to the dynamic capability perspective, organizational change can enhance adaptability and leverage knowledge, but it can also interrupt organizational routines and prompt conflicts based on organizational inertia. We classify organizational change as technical change or administrative change, and we predict their different positive and negative mechanisms according to two theories. This combination builds a theoretical foundation for the curvilinear effects of organizational change.

Third, we consider whether and how customer participation and innovation ambidexterity moderates the effects of technical and administrative change. Learning ability

depends on customer participation. Innovation ambidexterity is the ability to implement both explorative and exploitative innovation simultaneously. We identify the differential roles of these variables in the two types of change. Although customer participation is beneficial to technical change and strengthens its effect, customer participation and innovation ambidexterity both attenuate the effect of administrative change.

In addition to expanding organizational change literature by addressing research gaps related to the nonlinear and moderated relationship, we also offer some guidance to managers. First, organizational change should not be a single-dimension strategy; managers should pay attention to different aspects of organizational change, because those aspects truly differ. Technical change results from the implementation of new measures: ways to develop products, procedures to increase operational efficiency, methods to gain technological innovation, systems to update production equipment, or means to enhance product quality. Administrative change instead relates directly to the firm's management systems in departments such as finance, personnel training and management, and compensation (Tsoukas, 1996; Zhou et al., 2006).

Second, when firms begin to implement organizational change, they should identify the necessary levels of technical and administrative change that can produce positive performance outcomes. At low or moderate levels of technical (administrative) change, change harms firm performance. Only when it reaches certain levels can it improve firm performance. To identify these levels, firms must recognize the distinct positive and negative mechanisms of organizational change; organizational change promotes firm performance only if the positive mechanisms exceed negative mechanisms.

Third, customer participation and ambidexterity are essential facilitators, with distinct roles in the process of organizational change. Firms should match their different types of organizational change with different levels of customer participation and ambidexterity. If technical change is low (high), a strategy with a low (high) level of customer participation is better than one with a high (low) level of customer participation. For administrative change, while it is low (high), a strategy with a high (low) level of customer participation is better than one with a low (high) level of customer participation. In contrast, a low level of ambidexterity improves the effect of administrative change. To enhance the effects of administrative change, firms should pay close attention to their innovation implementation and focus on either exploitation or exploration, rather than pursue both forms of innovation.

The limitations of our study suggest some directions for research. In particular, we focus only on the high-tech industry, in which organizational change is common and important. In other industries (e.g., manufacturing), organizational change may be less common, and the moderating roles of customer participation and ambidexterity may differ. Additional studies thus should extend our research context. We also rely on dynamic capability and organizational inertia theories to examine customer participation and ambidexterity as potential moderators. We do not test for the mediation of these two theories and use them only as explanations (Fang, 2008; Zhou & Wu, 2010). In addition to the two moderators we consider, other variables might strengthen or attenuate the relationship between organizational change and performance. Further research could integrate other strategic variables, such as organizational flexibility, networking capability, and market orientation, to determine the differential effects of technical and administrative change.

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Appendix

Table 5 Measurement items and reliability and validity assessments

	Factor Loading	AVE	CR	Cronbach's Alpha
Organizational change (senior manager):				
Technical change		.543	.855	.782
Compared with last year (1: very low, 7: very high).:				
1. What are your firm's changes in developing new product	.760			
2. What are your firm's changes in production efficiency	.661			
3. What are your firm's changes in technological innovation on production	.780			
4. What are your firm's changes in production equipment	.742			
5. What are your firm's changes in product quality	.735			
Administrative change		.825	.959	.938
Compared with last year (1: very low, 7: very high):				
1. What are your firm's changes in financing system	.885			
2. What are your firm's changes in personnel training system	.925			
3. What are your firm's changes in personnel management system	.938			
4. What are your firm's changes in compensation and reward system	.863			
5. What are your firm's changes in senior management system	.928			
Customer participation (middle manager): second-order factor				
Information offering: First-order factor		.677	.863	.761
During customer participation process (1: strongly disagree; 7: strongly agree):				
1. We actively transferred information collected from customers into our development team.	.884			
2. We kept our manufacturer notified about what was happening in the market of our customers.	.775			
3. The transfer of information about customer needs and preferences is frequent.	.806			
Customer co-development: First-order factor		.754	.902	.836
During customer participation process (1: strongly disagree; 7: strongly agree):				
1. Customer effort played an important role in the completion of development tasks.	.870			
2. Customers' work constituted a significant portion of the overall effort.	.885			
3. Customer involvement as codeveloper of new product was quite critical.	.850			
Exploitation (middle manager): In the innovation, to what extent has your firm (1: very low, 7: very high):		.519	.843	.721
1. Upgraded current knowledge for familiar products?	.731			
2. Invested in exploiting mature technologies that improve the productivity of current innovation operations?	.718			
3. Enhanced abilities in searching for solutions to customer problems that are near to existing solutions?	.659			
4. Upgraded skills in product development processes in which the firm already possesses rich experience?	.722			

Table 5 (continued)

	Factor Loading	AVE	CR	Cronbach's Alpha
5. Strengthened the knowledge and skills to improve the efficiency of existing innovation activities?	.767			
Exploration (middle manager): In the innovation, to what extent has your firm (1: very low, 7: very high):		.523	.844	.754
1. Acquired manufacturing technologies and skills entirely new to the firm?	.793			
2. Learned product development skills and processes entirely new to the industry?	.608			
3. Acquired entirely new managerial and organizational skills that are important for innovation?	.747			
4. Learned totally new skills in funding new technology and training R&D personnel?	.784			
5. Strengthened innovation skills in areas where it has no prior experience?	.565			
Market growth (middle manager): (1: strongly disagree; 7: strongly agree):		.721	.886	.805
1. The growth rate of this industry in the past three years is very high.	.872			
2. The market demand in this industry is growing rapidly.	.831			
3. There are many potential customers in this industry to provide mass-marketing opportunity.	.844			
Technological turbulence (middle manager): (1: strongly disagree; 7: strongly agree):		.579	.804	.702
1. The technology in this industry is changing rapidly.	.808			
2. A large number of new product ideas have been made possible through technological breakthroughs in this industry.	.773			
3. It is very difficult to forecast where the technology in this area will be in the next few years.	.695			
Firm performance (senior manager): Compared with your major competitor, assess your firm's (1: very bad; 7: very good):		.597	.855	.771
1. Sales growth in the past two years	.792			
2. Return on investment	.761			
3. Profit level	.773			
4. Market share	.763			

AVE average variance extracted, *CR* composite reliability

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