

**Ambidextrous Organizational Culture, Contextual Ambidexterity and New Product
Innovation: A Comparative Study of UK and Chinese High-Tech Firms**

Catherine L. Wang*

Professor of Entrepreneurship and Innovation

School of Management

Royal Holloway, University of London

Egham Hill, Egham, Surrey, TW20 0EX, United Kingdom

Tel: +44 (0)1784 414299

Email: Catherine.Wang@rhul.ac.uk

Mohammed Rafiq

Reader in Retailing and Marketing

School of Business and Economics

Loughborough University

Loughborough, Leicestershire, LE11 3TU, United Kingdom

Tel: +44 (0) 1509 223397

Email: m.rafiq@lboro.ac.uk

* Corresponding author

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Authors' Biographies:

Catherine L. Wang is Professor of Entrepreneurship and Innovation at the School of Management, Royal Holloway University of London. Her research areas include entrepreneurial orientation, entrepreneurial learning, dynamic capabilities and innovation in cross-cultural research contexts. Mohammed Rafiq is Reader in Retailing and Marketing at the School of Business and Economics at Loughborough University. His research areas include e-service quality, relationship quality, e-loyalty, internal marketing, town centre retail image, market orientation, innovation and new product development.

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ABSTRACT

Contextual ambidexterity is of paramount importance for new product innovation and organizational success, particularly in high-tech firms operating in a dynamic environment. Whilst it is recognized that contextual ambidexterity is grounded in organizational culture, existing research has not crystallized what kind of organizational culture enables contextual ambidexterity and consequently new product innovation. In this paper, drawing on data from 150 UK and 242 Chinese high-tech firms, we conceptualize ambidextrous organizational culture as a higher-order construct consisting of organizational diversity and shared vision, and examine its impacts on contextual ambidexterity and consequently on new product innovation outcomes. Using structural equation modelling, we find significant relationships among ambidextrous organizational culture, contextual ambidexterity and new product innovation outcomes; contextual ambidexterity mediates the relationship between ambidextrous organizational culture and new product innovation outcomes. Our findings also suggest that the above relationships are robust in the UK-China comparative research context, and that contextual ambidexterity and new product innovation outcomes are dependent on business unit level heterogeneity (i.e. ambidextrous organizational culture and R&D strength) rather than industry or cross-cultural differences.

Key words: Contextual ambidexterity, ambidextrous organizational culture, new product innovation, UK and Chinese high-tech firms.

INTRODUCTION

Organizational ambidexterity as a metaphor referring to firms' ability to both explore new competences and exploit existing competences has attracted considerable interest (Tushman and O'Reilly 1996, 1997; Gibson and Birkinshaw 2004; Simsek et al. 2009; Raisch et al. 2009), especially in new product innovation research (He and Wong 2004; Atuahene-Gima 2005). Exploitation is recognized as conducive to incremental innovation and short-term performance, while exploration is required for radical innovation and long-term success (March 1991; Levinthal and March 1993). Balancing exploration and exploitation for the purposes of successful new product innovation and long-term survival is a critical and challenging task (March 1991; McGrath 2001; McNamara and Baden-Fuller 1999). Traditionally, exploration and exploitation are considered as competing organizational activities (Duncan 1976), and their balance is achieved through structural or temporal separation (Gupta et al. 2006; Simsek et al. 2009). However, recent research suggests that contextual ambidexterity (i.e. simultaneous exploration and exploitation within a business unit) is not only possible, but also a necessity to business success, especially in high-tech firms that often have no choice but to exploit existing competences for short-term commercial benefits and simultaneously explore new competences for long-term success (Gibson and Birkinshaw 2004). However, little research exists that addresses the enablers of contextual ambidexterity (Simsek et al. 2009).

It is argued that contextual ambidexterity is grounded in the type of organizational culture (Ghoshal and Bartlett 1994; Gibson and Birkinshaw 2004; Simsek et al. 2009) that promotes both creativity and discipline (Jelinek and Schoonhoven 1993), or both the presence of different knowledge and the integration of multiple perspectives to develop a cohesive point of view (Eisenhardt and Schoonhoven 1990). Traditionally, the dual demands of exploration and exploitation are considered paradoxical, and little is known about the

mechanisms to integrate them in the pursuit of contextual ambidexterity. Recent conceptual developments in organizational identification and organizational learning literatures argue that diverse individual knowledge, skills and abilities that promote creativity (which we refer to as 'organizational diversity', see below), provided that these differences reflect shared expectations and group norms that confer discipline (which we refer to as 'shared vision', see below), can go hand in hand with, or even form the basis for a shared organizational identification (Rink and Ellemers 2007). This provides an insight into the type of organizational culture required for contextual ambidexterity, but has not been conceptually integrated nor examined in the organizational ambidexterity and innovation literatures. Therefore, our first objective is to conceptualize and examine ambidextrous organizational culture (consisting of organizational diversity and shared vision) as an antecedent to contextual ambidexterity and consequently new product innovation outcomes.

The interest in the above relationships increases in a cross-cultural research context. For example, the literature is divided as to what extent firms' radical and incremental innovative capabilities are related to national culture (van Everdingen and Waarts 2003), or organizational culture (Tellis et al. 2006). This suggests that the extent to which firms in different nations explore and exploit may vary, and more research is needed to examine the relationships between ambidextrous organizational culture, contextual ambidexterity and new product innovation in a cross-cultural context. Specifically, we compare UK and Chinese high-tech firms. The UK and China are not only representative of the Western and Eastern cultures (Hofstede 2001), but also widely recognized for their contrasting competences in exploration and exploitation. Hence, our second objective is to examine the robustness of the relationships between ambidextrous organizational culture, contextual ambidexterity, and new product innovation outcomes in UK and Chinese high-tech firms.

In sum, our objectives and intended contributions to theory are mainly two-fold. First, we borrow insights from the organizational identity and organizational learning literatures to conceptualize ambidextrous organizational culture and examine its effects on contextual ambidexterity and consequently new product innovation outcomes. We contribute to the organizational ambidexterity and innovation literatures by providing further evidence of contextual ambidexterity, challenging the traditional approaches. More importantly, we explicate how contextual ambidexterity takes place, enhancing the understanding of the enablers of contextual ambidexterity and resolving the paradox of 'capability-rigidity' or 'competence exploration-exploitation' (Atuahene-Gima 2005). Second, we compare and contrast the extent to which the relationships between ambidextrous organizational culture, contextual ambidexterity and new product innovation outcomes vary between UK and Chinese firms across different high-tech industries. We contribute to organizational ambidexterity and innovation literatures by examining the applicability and robustness of contextual ambidexterity and its antecedents and consequences in a cross-cultural context. Additionally, our findings have practical and methodological implications.

THEORETICAL BACKGROUND AND RESEARCH HYPOTHESES

Contextual ambidexterity

At the centre of organizational ambidexterity lies a key debate as to whether exploration and exploitation are competing or complementary facets of firms' decisions and actions (Gupta et al. 2006). The former considers exploration and exploitation as a bi-polar construct, lying on the opposite ends of a single continuum; exploration and exploitation place inherently conflicting demands on organizational resources, their trade-off effect being unavoidable (e.g. Simsek et al. 2009 for a detailed discussion). Reflecting such competing nature, three generic types of ambidexterity are commonly identified. First, the structurally

separated or partitioned ambidexterity (Simsek et al. 2009) can be traced to Duncan's (1976) work on the organizational design dilemma required for the different stages (initiation and implementation) of the innovation process; the way to achieve ambidexterity is by creating separate business units with dual structures, systems and cultures for exploration and exploitation (Duncan 1976). The key challenge for partitioned ambidexterity lies in the coordination of exploratory and exploitative activities across independent business units, often through the presence of an overarching strategic vision (O'Reilly and Tushman 2007), a shared vision among senior management team (Jansen et al. 2008), senior management team coordination (Lubatkin et al. 2006), and knowledge integration systems (Tiwana 2008). Second, exploration and exploitation can take place within the same business unit, but in a cyclical or sequential manner (Simsek et al. 2009). Gupta et al. (2006) emphasize that punctuated equilibrium - temporal cycling between long periods of exploitation and short bursts of exploration within the same business unit is an alternative balancing mechanism that may be both logical and practical. Since cyclical ambidexterity involves changes in formal structures, routines and systems, its key challenge lies in managing conflicts, maintaining effective interpersonal relations and developing mechanisms that facilitate the switch between exploration and exploitation (Floyd and Lane 2000; Duncan 1976). Finally, exploration and exploitation may take place sequentially across different business units, which is labelled as reciprocal ambidexterity (Simsek et al. 2009). Reciprocal ambidexterity bears the coordination costs incurred due to structural separation and transition costs due to temporal separation (Simsek et al. 2009).

Unlike the above, contextual ambidexterity (Birkinshaw and Gibson 2004) or harmonic ambidexterity (Simsek et al. 2009) considers exploration and exploitation as complementary organizational activities, and organizational ambidexterity as a multidimensional construct consisting of simultaneous exploration and exploitation in a

business unit. Essentially, contextual ambidexterity emphasizes the integration of exploration and exploitation within a single business unit but allows for differentiated effort in both activities. The advantage of contextual ambidexterity over the traditional approaches is increasingly recognized in research and business practice. First, as Gibson and Birkinshaw (2004) note, the demands on a firm in a task environment are always to some degree in conflict. Indeed, firms, especially high-tech firms operating in a dynamic market environment, are often left with no choice but to consolidate existing businesses while simultaneously finding new opportunities. Therefore, contextual ambidexterity is often a matter of necessity for firms to succeed in the short-term and achieve long-term sustainability. Second, contextual ambidexterity epitomizes the development of an entire firm geared towards the integration of exploration and exploitation through a process of organizational learning, thus avoiding the coordination costs incurred due to structural separation and transition costs due to temporal separation (Simsek et al. 2009). This organizational benefit of contextual ambidexterity is widely recognized (e.g. Gibson and Birkinshaw 2004; Kang and Snell 2009). For example, in the context of university spin-offs, Chang et al. (2009) find that contextual ambidexterity outperforms structural ambidexterity.

Despite these benefits, contextual ambidexterity is exceptionally challenging to implement because it requires not only organizational slack resources to allow exploratory activities (Judge and Blocke 2008) but also effective mechanisms to integrate exploration and exploitation (Gibson and Birkinshaw 2004). Until recently, the literature has focused largely on the integration mechanisms of structurally and temporally separated ambidexterity. For example, Jansen et al. (2009) study the senior team integration mechanisms (e.g. contingency awards and social integration) and organizational integration mechanisms (e.g. cross-functional interfaces and connectedness) in structurally separated ambidexterity. More research is needed to understand how to integrate exploration and exploitation within a

business unit. Conceptually, the pursuit of contextual ambidexterity must be intertwined in the ongoing operating and strategic activities of a business unit (Simsek et al. 2009), placing a premium on individuals' ability to make own judgement about how to divide time between exploratory and exploitative activities and their ability to integrate both activities (Gibson and Birkinshaw 2004). Essentially, contextual ambidexterity can be viewed as a distinctive organizational capability that is complex, widely dispersed, and time-consuming to develop (Amit and Schoemaker 1993); it requires a bottom-up approach, emphasizing the involvement and participation of individual members as part of the organizational culture and context (Ghoshal and Bartlett 1994; Gibson and Birkinshaw 2004; Simsek et al. 2009). However, more research is required to understand what kind of organizational culture enables contextual ambidexterity (Simsek et al. 2009), how contextual ambidexterity can be achieved through involving individual organizational members or under what conditions it is successful (Güttel and Konlechner 2009).

Ambidextrous Organizational Culture

Organizational culture is "the underlying values, beliefs, and principles that serve as a foundation for an organization's management system as well as the set of management practices and behaviours that exemplify and reinforce those basic principles" (Denison 1990: 2). It forms the informal, behavioural part of organizational context (Denison 1996), complementing the formal, structural component (e.g. processes and systems). Organizational culture has four traits: (a) perceived involvement and participation on the part of organizational members; (b) adaptability in response to external conditions without abandoning one's underlying character; (c) normative integration and consistency; and (d) a mission combining economic and noneconomic objectives; mission and consistency ensure stability and direction, while adaptability and involvement allow change and flexibility

(Denison and Mishra 1995). Organizational culture is developed as an organization learns to cope with the dual problems of direction and flexibility as well as external adaptation and internal integration (Schein 1990). The dual aspects of organizational culture intertwined in the process of organizational learning underpin our conceptualization of ambidextrous organizational culture.

Commenting on the type of organizational culture and context required for contextual ambidexterity, Gibson and Birkinshaw (2004) argue that a business unit must avoid both too much discipline and a 'country club' atmosphere. They further examine the influence of discipline, stretch, support and trust as four dimensions of organizational context on contextual ambidexterity. However, their study raises several issues. First, the four dimensions of organizational context were initially developed by Ghoshal and Bartlett's (1994) as four behaviour-framing attributes that engender individual-level behaviours resulting in initiative, cooperation and learning, rather than exploration and exploitation. Gibson and Birkinshaw (2004) themselves recognize these conceptual limitations. Second, Gibson and Birkinshaw (2004) find no support for this four-dimensional organizational context, but result in two organizational contexts: performance management context that represents a combination of discipline and stretch, and social context that represents a combination of support and trust. Essentially, these contexts reflect the processes and systems of the business unit, rather than the underlying values and norms promoting contextual ambidexterity. Therefore, the question remains as to what kind of organizational culture facilitates the development of systems, structures and processes that enable 'a loose-tight relationship' required for contextual ambidexterity (Güttel and Konlechner 2009).

Recent work on organizational identification, an important dimension of organizational context (Litwin and Stringer 1968; Denison 1996), sheds some light on this missing link. Commenting on the traditional view that any kind of diversity is negatively

related to the formation of a common identity (Harrison et al. 1998; Jackson et al. 2003) and that a sense of joint group membership is developed when individuals perceive similarities to other group members (Williams and O'Reilly 1998), Rink and Ellemers (2007) reckon that this simplistic understanding does not really reflect the complex cognitive and perceptual process of self-definition and organizational identification. Instead, Rink and Ellemers (2007: S18) argue for a bottom-up process of reconciling diversity (or task-related differences in terms of knowledge, skills and abilities) and group norm congruity to develop a common organizational identity:

"...(a) when team members expect task-related differences among them prior to collaboration, or (b) when it is obvious from the outset of the collaboration that they are different from each other in task-related ways. Under these circumstances, we argue that diversity will be seen as congruent with group norms, and that people are most likely to recognize and acknowledge the value of task-related differences for their team and for the organization as a whole."

Essentially, Rink and Ellemers (2007) argue that diversity that encourages creativity can be integrated into group norms that provide direction and discipline. Drawing on such insights, we focus on two sets of organizational values and norms, namely 'organizational diversity' and 'shared vision', which together constitute what we call 'ambidextrous organizational culture'. Specifically, we define organizational diversity (henceforth, OD) as the set of organizational values and norms that encourage and tolerate differences, and recognize and reward individuals' different viewpoints, skills and knowledge, as informed by Ferner et al.'s (2005) work on diversity. Hence, we focus on the intangible aspect of organizational diversity emphasizing its role in organizational learning. This departs from the

traditional definition of diversity in terms of heterogeneity of workforce demographics (visible characteristics), such as gender, age and ethnicity of the workforce (Cox 1994). Our definition of OD is a business unit level concept, reflecting cultural norms that respect task-related differences in information, knowledge, and perspectives, in line with Rink and Ellemers (2007).

We define shared vision (henceforth, SV) as the set of organizational values and norms that promote the overall active involvement of organizational members in the development, communication, dissemination, and implementation of organizational goals, building on the work by Senge (1990), Sinkula et al. (1997) and Patterson et al. (2005). We are again informed by the organizational learning theory following a bottom-up process of developing a common vision within a business unit (Sinkula et al. 1997), rather than the traditional top-down approach to goal orientation and consensus building in strategy and leadership literatures (Thompson and Tuden 1959). This bottom-up process is consistent with Rink and Ellemers (2007). SV is a transformational mechanism of a learning organization (Senge 1990; Sinkula et al. 1997), in which individual members play an active role in creating their own organizational culture (Wilkins and Ouchi 1983). Hence, SV underpins what Gibson and Birkinshaw (2004) refer to as 'integrative judgments' of individuals. In line with Rink and Ellemers (2007), we argue that OD and SV can be integrated in a business unit, constituting a higher-order construct of ambidextrous organizational culture. However, such organizational culture takes time to develop, and hence can be viewed as a causally ambiguous organizational resource (Gibson and Birkinshaw 2004).

Research Hypotheses

Below, we delineate the respective roles of OD and SV in competence exploration and exploitation, and then how OD and SV form a higher-order construct of ambidextrous

organizational culture (as a causally ambiguous organizational resource) affecting contextual ambidexterity (as a distinctive organizational capability). OD embodies such values that encourage individuals to think originally, behave autonomously and innovatively, and generate multiple perspectives and viewpoints. These multiple perspectives help bring about broader cognitive and mental maps, increasing the likelihood of preventing myopic thinking and prompting creative resource solutions (Huber 1991). Therefore, diversity helps the organization to avoid the tendency of favouring familiar solutions over unfamiliar ones (Ahuja and Lampert 2001). This is not only fundamental to exploration, but also to some extent exploitation in terms of generating new ideas to improve systems and processes of exploitation. Although too much diversity may be counter-productive as it may increase costs of management, monitoring, and integration required for exploitation (Katila and Ahuja 2002; Simsek 2009), in reality not many firms are likely to reach a level of OD that is high enough to induce dramatic increase in costs outweighing the benefits of generating multiple and potentially better solutions to problems (Ahuja and Lampert 2001; Katila and Ahuja 2002).

SV gives organizational members a sense of purpose and a rationale to be good agents, increasing their willingness to subordinate their individual goals and actions for collective goals and actions (Leana and van Buren 1999). The congruence of individual values with organizational values creates a 'bonding effect' - the foundation of trusting relationships among organizational members as it helps reduce conflicts and provide the harmony of interests that alleviates opportunistic behaviour (Ouchi 1980). Such bonding mechanism is important for effective resource exchange and integration (Tsai and Ghoshal 1998), particularly when various opportunities emerge whilst limited resources are available for deployment. Therefore, SV promotes the integration of an entire business unit, holding together a loosely-coupled system (Orton and Weick 1990). Consequently, SV encourages

collective behaviour, which in turn creates team efficiency valuable in translating diverse ideas into focused actions required for exploitation (McGrath et al. 1994).

Further, OD and SV reinforce each other constituting a higher-order construct of ambidextrous organizational culture, which in turn affects the integration of exploration and exploitation in a business unit. Successful innovation not only requires that a business unit come up with creative ideas, but most importantly, evaluate multiple perspectives to produce a cohesive point of view in line with the organizational goal (Eisenhardt and Schoonhoven 1990). In the presence of a shared vision, organizational members are likely to be driven by collective goals and values, and individual opportunistic behaviours are likely to be mitigated (Ouchi 1980). Under such conditions, organizational members are inclined to trust one another and hence willingly contribute diverse ideas and explore new knowledge and alternative solutions without fear of repercussions, as they can expect that they all work toward collective goals and will not be hurt by any other member's pursuit of self-interest (Tsai and Ghoshal 1998). Moreover, SV helps organizational members to see the potential value of their knowledge exchange in line with the organizational goals, and promotes shared representations and interpretations of information among individuals and filtration of useful information based on its value to the organizational goals. Hence, SV provides a direction for organizational learning (Sinkula et al. 1997), reining in different perspectives associated with OD. An organization with a SV is more likely to relate multiple perspectives to the existing knowledge in line with organizational goals. Specifically, in the context of new product development, SV enables the firm to select appropriate creative ideas to pursue, as guided by the organizational objectives. Without OD, a business unit is likely to be trapped in familiar solutions with little exploration; without a SV, the reality of a business unit would be characterized by highly enthusiastic and committed individuals pulling it in different directions with many ideas under-exploited or unexploited. Therefore, OD and SV as

component factors of a higher-order construct of ambidextrous organizational culture enable contextual ambidexterity. Hence, we hypothesize that:

H1: Ambidextrous organizational culture has a positive impact on contextual ambidexterity.

Given that the exploration and exploitation relationship is intrinsically linked to the capability-rigidity paradox in innovation (Leonard-Barton 1992), several studies (e.g. He and Wong 2004; Atuahene-Gima 2005) have focused on radical and incremental product innovation outcomes. Incremental product innovations refer to "product improvements and line extensions that are usually aimed at satisfying the needs of existing customers", which involve "small changes in technology and little deviation from the current product-market experiences of the firm". Radical product innovations "involve fundamental changes in technology for the firm, typically address the needs of emerging customers, are new to the firm and/or industry, and offer substantial new benefits to customers" (Atuahene-Gima 2005: 65).

Under the traditional bi-polar view of ambidexterity, exploitation is seen as associated with efficiency and productivity through the use of existing or similar solutions, but the existing knowledge frame hinders breakthrough innovations. Therefore, exploitation facilitates learning through knowledge refinement with moderate but certain and immediate returns (Hughes et al. 2007), increasing incremental product innovations but hindering radical innovation (Christensen and Bower 1996). Conversely, exploration promotes learning through knowledge creation with potentially high but uncertain returns (Hughes et al. 2007), but often at the expense of efficiency. Therefore, exploration increases radical product innovations, but impedes incremental innovations (Atuahene-Gima 2005). As a result, extant research has

largely examined the respective effects of exploration and exploitation on radical and incremental product innovations, and a balance of exploration and exploitation is often gauged through their interaction effect (Atuahene-Gima 2005) or aggregate dimension (He and Wong 2004). Interestingly, Atuahene-Gima (2005) finds that the interaction effect of exploration and exploitation negatively impacts on radical product innovations and has no significant effect on incremental product innovations. He then suggests that exploration will be more valuable to the firm when it is matched with a lower level of exploitation, and vice versa. This finding essentially contradicts the principles of contextual ambidexterity. Hence, more research is needed to examine the effect of contextual ambidexterity on new product innovation outcomes, responding to the call for research to examine the organizational outcomes of contextual ambidexterity (Simsek et al. 2009).

Conceptually, the integration of exploration and exploitation enhances performance by enabling an organization to be "innovative, flexible, and effective without losing the benefits of stability, routinization, and efficiency" (Simsek 2009: 603). In other words, contextual ambidexterity helps rein in the different forces in radical and incremental product innovations (Yang and Atuahene-Gima 2007). It is critical that a vision that expounds the necessity and logic of ambidexterity is articulated and clearly communicated among organizational members to ensure that the differentiated efforts in exploration and exploitation does not inhibit the business unit's ability to succeed at either activity (Simsek et al. 2009). Business units that are good at contextual ambidexterity should be capable of integrating experimentation and risk-taking involved in radical innovation and the efficiency and production required for incremental innovation. The latter is related to speed to market in new product development, or launching new products faster. Speed to market is a critical success factor especially for high-tech firms to capitalize on first mover advantage and gain competitiveness. A plethora of studies have identified a range of factors that influence speed

to market (Akgün and Lynn (2002). However, little research exists to provide evidence on speed to market as part of a business unit's effort to balance its new product innovation outcomes resulting from a distinctive capability of contextual ambidexterity. Hence, we consider radical and incremental product innovations and speed to market as the component factors of balanced new product innovation outcomes. Accordingly, we hypothesize that:

H2: Contextual ambidexterity has a positive impact on new product innovation outcomes.

Gibson and Birkinshaw (2004) recognize that an organizational culture supporting contextual ambidexterity is a causally ambiguous organizational resource, which is time-consuming to develop, difficult for others to imitate, and hence invaluable to the business unit. Such an organizational culture enables the development of the business unit's ability to integrate exploration and exploitation - a performance-enhancing distinctive capability (Yang and Atuahene-Gima 2007). It is through contextual ambidexterity (as a distinctive organizational capability) that ambidextrous organizational culture (as a causally ambiguous organizational resource) generates performance outcomes; this is in line with the resource-based view of the firm arguing that it is firms' distinctive capabilities of reconfiguring, bundling and deploying resources (Amit and Schoemaker 1993) that create differential performance. Accordingly, we hypothesize:

H3. Contextual ambidexterity mediates the relationship between ambidextrous organizational culture and new product innovation outcomes.

RESEARCH METHODS

Sample

We applied the following criteria to select samples of UK and Chinese firms: (a) firms in operation for at least three years; (b) firms with at least 50 employees; (c) firms that had introduced at least one radically or incrementally new product in the past three years; (d) firms that operated in a high-tech industry, producing technologically sophisticated products and services (OECD 1999). Specifically, we included consumer electronics, life sciences (including pharmaceutical, bio-technology, and medical equipment), and information and communication technologies and emerging technologies (including software development, data storage and displays, data processing, and sensor and imaging technologies) (ICT); and (e) Chinese firms that are privately owned enterprises, as state-owned organizations are considerably different.

Based on the above criteria, our final UK sample consisted of 1,300 high-tech companies headquartered in the UK (excluding Northern Ireland) compiled from published databases (FAME, MINT and Kompass). The Chinese sample selection posed a challenge due to China's large size and great regional variance, as Roy et al. (2001: 204) comment, "In the best of circumstances, it is difficult to derive probability samples that are representative for all of China." Accordingly, Zhao et al. (2006) suggest that sampling in China should concentrate on those industries or geographical areas most suitable to the research focus. Since the capacity and achievement in high-tech industries is much stronger in major cities of China (Yam et al. 2004), we focused our sample on firms located in three major cities, Beijing, Shanghai and Shenzhen. Our final Chinese sample consisted of 1,900 high-tech companies compiled from published databases (ORISIS and ALIBABA).

Survey Design and Administration

We developed equivalent English and Chinese versions of the questionnaire, following Douglas and Craig's (2007) guidelines. The process involved independent translations and back-translations in iterative processes, a focus group of three bilingual researchers, a pre-test among four academic experts, a pre-test amongst ten UK and Chinese companies, and a second focus group of five bilingual researchers and five native Chinese speakers.

We used 10-point Likert scales, as they help to reduce the statistical problems of extreme skewness (Fornell 1992), and potentially provide a greater variance in responses. This technique is particularly useful in the Chinese research context (Whitcomb et al. 1998). The UK data were gathered via a mailed survey. A questionnaire was sent by post with a cover letter to the company director or executive and a pre-paid return envelope. Following one mailed reminder and a telephone call, we received a total of 176 responses. After deducting 26 unusable responses, 150 valid questionnaires remained (a 11.5% effective response rate). This response rate falls in the 10-12% rate that Hambrick et al. (1993) described as typical for surveys of executives. Respondents primarily included company directors and senior managers in Research & Development (R&D) and Marketing. Following Armstrong and Overton's (1977) recommendation, we divided responses into three groups based on whether they responded to the first mailing, the first mailed follow-up, or the second telephone follow-up, assuming that the last group was most similar to non-respondents. There was no significant difference in the studied variables between the three groups, suggesting that there was no evidence of systematic non-response bias.

The Chinese data were collected through structured telephone interviews because interviewing is regarded as a more reliable method than mailed surveys; the latter are extremely difficult to conduct in China (Zhao et al. 2006; Roy et al. 2001). Using two different data collection methods in international research involving a Chinese sample is a

common practice (see Atuahene-Gima and Li 2002; Luo et al. 2005). A total of 252 responses were obtained from general managers (company directors) and senior managers in R&D and Marketing; deducting 10 unusable responses, 242 valid questionnaires remained; a 12.7% effective response rate. This response rate falls in the typical 10-15% response rate in Chinese studies mentioned by Wang et al. (1998). Table 1 summarizes the profiles of respondent firms.

INSERT TABLE 1 HERE

Measures

We used established measures where relevant except for OD. All the questions concerned issues at the business unit level, rather than at the corporate level. OD was developed based on the work of Ferner et al. (2005), consisting of three items. These measures are in line with Rink and Ellemers's (2007) focus on diverse knowledge, skills and abilities. SV was measured using four items drawn from Sinkula et al.'s (1997) shared vision construct and Patterson et al.'s (2005) clarity of organizational goals. SV and OD were hypothesized as the component factors of the higher-order latent construct of ambidextrous organizational culture. This means ambidextrous organizational culture was indirectly measured through its component factors, which were in turn measured by the questionnaire items (see Appendix 1).

Similarly, competence exploration and exploitation were hypothesized as the component factors of the higher-order latent construct of contextual ambidexterity, whilst their measures were adopted from Atuahene-Gima's (2005) constructs, each consisting of five items. Although extant research conceptualizes contextual ambidexterity as a multidimensional construct consisting of simultaneous exploration and exploitation (Gibson and Birkinshaw 2004; Menguc and Auh 2008; Simsek 2009; Kang and Snell 2009), empirical

work has largely deviated from the conceptual stance by treating exploration and exploitation as two different constructs using their interaction effect (Gibson and Birkinshaw 2004) or aggregate dimension (i.e. combination or absolute difference) (He and Wong 2004) as proxies of contextual ambidexterity. The misalignment between conceptualization and operationalization of contextual ambidexterity hinders its further development, possibly introducing bias to the understanding of the concept (Lubatkin et al. 2006; Hughes et al. 2010). Hence, more research is needed to incorporate contextual ambidexterity as a higher-order construct, consisting of exploration and exploitation as components.

New product innovation outcomes was conceptualized as a higher-order construct consisting of radical product innovation, incremental product innovation and speed-to-market. Radical and incremental product innovation was each measured using two items to indicate to what extent the business unit frequently and prolifically introduce radically or incrementally new products in the past three years (Atuahene-Gima 2005), whilst speed to market was measured using four items used by Akgün and Lynn (2002). Confirmatory factor analyses of the above measures were performed where necessary and the results were satisfactory. Cronbach's alphas were also satisfactory (see Table 2).

INSERT TABLE 2 HERE

Control Variables

The extent to which new product innovation outcomes vary due to firm- (or business unit level) or industry-specific heterogeneity has been a major area of interest. For example, research suggests that the emphasis on radical and incremental innovations is dependent on the industry life cycle (Gort and Klepper 1982), and that firm-level R&D resources must be considered within the industry context (Mazzucato and Tancioni 2008). Given this debate, we

included three control variables: (a) industry type as categorized into consumer electronics (n=129), life sciences (n=95) and ICT (=168); (b) relative R&D strength at the business unit level as measured by the self-perceived strength of R&D resources in relation to key competitors; this was categorized into low R&D strength group (n=181) and high R&D strength group (n=211) in relation to the mean of R&D strength (5.10 based on a 10-point Likert scale); and (c) relative marketing strength at the business unit level as measured by the self-perceived strength of marketing resources in relation to key competitors; this was categorized into low marketing strength group (n=169) and high marketing strength group (n=223) in relation to the mean of marketing strength (5.91 based on a 10-point Likert scale).

Finally, we controlled the effect of the UK vs. China group to examine the extent to which the hypothesized relationships vary between UK and Chinese firms for three main reasons. First, high-tech firms in China experience a high degree of technological and institutional uncertainty (Peng and Health 1996). They are more likely to make considerably different strategic choices, resulting in substantial variability in their degree of exploration and exploitation (Cao et al. 2009). Thus, organizational ambidexterity in Chinese high-tech firms makes an interesting and timely research focus. Second, it is conventionally believed that China's increasingly prominent role in the global innovation system relies on its distinctive innovative capability based on exploiting ideas of others (NESTA 2007). This presents a marked difference from UK firms with strengths in exploration and scientific discovery (OECD 2007; HM Treasury 2003). Therefore, it is meaningful to compare the extent of contextual ambidexterity between UK and Chinese firms. Third, the question as to why and to what extent firms in different nations demonstrate different propensity towards exploration and exploitation still remains. One stream of literature argues that firms' differential capabilities are partly due to differences in national culture (van Everdingen and Waarts 2003), as national traits are embedded in individual attitudes and behaviour, which

influence managerial decision-making on innovation adoption. The other stream of literature argues that it is firm culture, rather than national culture, that influences a firm's radical innovation (Tellis et al. 2006). Further research is therefore needed to examine the effect of organizational culture on new product innovation across firms in cross-cultural contexts.

Common Method and Social Desirability Bias

To control for potential common method bias arising from using self-reported data from single informants (Podsakoff et al. 2003), we first assured the respondents of the confidentiality and anonymity to reduce evaluation apprehension - a procedural method recommended by Podsakoff et al. (2003). Second, we collected objective data on firm size and firm age from published databases, which had a high correlation coefficient with the subjective data reported by the informants. This suggests the absence of self-reported method bias. Third, we conducted the Harman's one-factor test (Podsakoff and Organ 1986), a technique often adopted by researchers to examine the common method bias. All study variables were entered into an exploratory factor analysis. The results revealed that no single factor emerged from this analysis, nor was there a general factor which could account for the majority of variance in these variables. The above evidence suggests that the common method bias was not a major problem in this study.

Social desirability bias (SDB) – the 'faking good' or 'faking bad' effect -is a potential threat to research particularly in China given that Chinese people show a strong attitudinal and behavioural tendency towards 'saving face'. To control the SDB effect in both samples, we included Reynolds's (1982) 13-item construct of social desirability, which is a validated, short form of the so-called Form-C of the original Marlowe-Crowne scale (Crowne and Marlowe 1960). Based on the procedures recommended by Fisher and Katz (2000), we calculated a SDB-corrected value for each of our main constructs and variables (see Tables

1&2), which was used in our analysis below to partial out the SDB effect on the tested relationships.

RESULTS AND ANALYSIS

We used structural equation modelling (SEM) to test H1 and H2, with ambidextrous organizational culture, contextual ambidexterity and new product innovation outcomes as three latent constructs (see Figure 1). The model fit statistics were satisfactory: $\chi^2=44.39$, $df=24$, $\chi^2 / df =1.85$, GFI=0.97, CFI=0.98, RMSEA=0.05, and RMR=0.12. The standardized path coefficients from ambidextrous organizational culture to contextual ambidexterity and from context ambidexterity to new product innovation outcomes were significant: 0.85 ($p<0.001$) and 0.57 ($p<0.001$) respectively for the UK sample, and 0.92 ($p<0.001$) and 0.75 ($p<0.001$) respectively for the Chinese sample (see Figure 1). These suggest that H1 and H2 are supported.

There are two approaches to test a mediating effect. Traditionally, Baron and Kenny's (1986) three conditions for partial mediation effect are used in regression models. However, recent development in SEM techniques suggest that Baron and Kenny's (1986) approach presumes a partial mediation baseline model, which is inappropriate for SEM; instead, in SEM a full mediating model should be tested with a path from the independent variable to the mediator and then a path from the mediator to the dependent variable; a direct relationship between the independent variable and the dependent variable is not expected (MacKinnon et al. 2002; James et al. 2004; Schneider et al. 2005). We followed the SEM approach to test the mediating effect in H3. We added a link from the independent variable (ambidextrous organizational culture) to the dependent variable (new product innovation outcomes), which resulted in an insignificant path coefficient: -0.01 ($p=0.982$) for the UK sample and -0.43 ($p=0.322$) for the Chinese sample (see Figure 1). This, together with the results for H1 and H2,

suggests that contextual ambidexterity fully mediated the relationship between ambidextrous organizational culture and new product innovation outcomes. Hence, H3 is supported.

INSERT FIGURE 1 HERE

To further examine whether OD and SV together constituted a higher-order construct of ambidextrous organizational culture, we tested a competing model in which OD and SV each was directly linked to contextual ambidexterity, rather than as components of a higher-order construct (see Figure 2). Although the standardized path coefficients from OD and SV to contextual ambidexterity respectively were significant: 0.34 ($p < 0.001$) and 0.53 ($p < 0.001$) for the UK sample and 0.44 ($p < 0.001$) and 0.53 ($p < 0.001$) for the Chinese sample, the model fit statistics were $\chi^2 = 156.11$, $df = 26$, $\chi^2 / df = 6.00$, $GFI = 0.91$, $CFI = 0.89$, $RMSEA = 0.11$, $RMR = 0.31$. These results suggest that the competing model (Figure 2) significantly worsened compared with the hypothesized model (Figure 1) ($\Delta\chi^2 = 111.72$, $\Delta df = 2$, $p < 0.001$), providing further evidence for OD and SV as components of a higher-order construct of ambidextrous organizational culture.

INSERT FIGURE 2 HERE

We performed SEM multigroup analyses to examine if there was significant difference in the hypothesized relationships between the UK and the Chinese samples - a control variable. As shown in Table 3, the unconstrained model where parameters were freely estimated resulted in $\chi^2 = 44.39$, $df = 24$. Two constrained models were compared with this unconstrained model: Constrained Model A (where only the path from ambidextrous organizational culture to contextual ambidexterity was specified as equal across groups)

resulted in $\chi^2=45.78$, $df=25$; and Constrained Model B (where only the path from contextual ambidexterity to new product innovation outcomes was specified as equal across groups) resulted in $\chi^2=44.39$, $df=25$; The χ^2 of each constrained model was not significantly higher than the unconstrained model (see Table 3), indicating there was no difference in the hypothesized relationships across the two sample groups.

The effects of other control variables were also tested using multigroup analyses. The results demonstrated the effects of industry type and marketing strength on the hypothesized relationship were insignificant, given that $\Delta\chi^2$ of the constrained models was not significant (see Table 3). Therefore, the hypothesized relationships did not vary across industry groups or business unit level marketing strength. However, R&D strength had a significant effect on the hypothesized relationships, as evidenced by the significant $\Delta\chi^2$. Specifically, the standardized path coefficient from contextual ambidexterity to new product innovation outcomes was 0.41 for the low R&D strength group, and 0.62 for the high R&D strength group.

INSERT TABLE 3 HERE

DISCUSSION

We contribute to the organizational ambidexterity and innovation literatures in two main ways. First, our study provides evidence to support that contextual ambidexterity is possible in practice, particularly in high-tech firms. In other words, exploration and exploitation, if managed properly, can be complementary organizational activities in the innovation process within a business unit (Gibson and Birkinshaw 2004; Simsek et al. 2009), rather than competing activities that can only exist in alternative structural architectures (Duncan 1976) or along a temporal dimension (Gupta et al. 2006). We argue that the implementation of contextual ambidexterity requires a fundamental change of management

mentality, that is, from the traditional top-down approach emphasizing the role of leadership and formal structure and governance (Tushman and O'Reilly 1996; Duncan 1976) to a bottom-up learning approach recognizing the role of individual members in developing and shaping organizational culture and integrative capabilities of exploration and exploitation. The bottom-up approach to organizational development has been a major theme in organizational learning (Senge 1990; Sinkula et al. 1997; Patterson et al. 2005) and organizational identity research (Rink and Ellemers, 2007), but unfortunately has not thus far been integrated in the organizational ambidexterity research. Our study helps bridge this research gap.

More importantly, our study sheds new light on the mechanisms that allow contextual ambidexterity to take place in organizations. In this paper, we examined the joint effects of OD and SV in forming what we call a higher-order construct of 'ambidextrous organizational culture', and its effect on contextual ambidexterity and consequently on new product innovation outcomes. Extant ambidexterity and innovation research has touched on the respective roles of OD and SV, but has not integrated them into a higher-order construct. The key message from our findings is that a business unit's values and norms that simultaneously integrate OD and SV enable it to effectively integrate exploration and exploration in the business unit, which in turn allows the firm to balance its new product innovation outcomes in terms of radical and incremental innovations and speed-to-market.

Whilst the traditional, simplistic view considers OD and SV as incompatible, our findings are consistent with Rink and Ellemers's (2007) norm congruity principle: provided that diverse individual knowledge, skills and abilities promoting creativity reflect shared expectations and group norms conferring discipline, OD and SV can mutually reinforce each other enabling a 'loose-tight relationship' (Güttel and Konlechner 2009) required for contextual ambidexterity. SV ensures the provision of a set of few simple, formal rules in terms of the overall organizational vision and direction, while OD encourages creativity to

flourish under the few simple rules (Güttel and Konlechner 2009). Ambidextrous organizational culture is a causally ambiguous, widely dispersed organizational resource, on which contextual ambidexterity is developed. Moreover, the mediating effect of contextual ambidexterity on the relationship between ambidextrous organizational culture and new product innovation outcomes suggests that it is through developing a distinctive capability of contextual ambidexterity that ambidextrous organizational culture as a causally ambiguous resource creates new product innovation outcomes. This responds to Simsek's (2009) call for research to understand the antecedents to, and outcomes of, contextual ambidexterity.

Our second contribution is that we found that the notion of contextual ambidexterity transcends national boundaries (i.e. UK and Chinese firms), and is applicable in cross-national research. Consistent with Tellis et al.'s (2006) findings on firm culture and innovation, we find that it is the business unit level heterogeneity, such as ambidextrous organizational culture and R&D strength, that play a major role in contextual ambidexterity and consequently new product innovation. We also find that these relationships are robust in both the UK and Chinese samples, and across different industry groups. This goes against some of the conventional stereotyping of innovative capabilities of UK and Chinese firms, that is, UK firms are better at exploration compared with Chinese firms, and vice versa, Chinese firms are better at exploitation. This could be due to the fast upgrade of Chinese high-tech firms in developed cities unlike those low-tech firms in developing regions which are stuck in the low-value adding activities. Additionally, many Chinese high-tech firms are part of a global innovation system pushing them to upgrade their technology and capabilities. In sum, our findings based on our study of three industry groups in two countries suggest that contextual ambidexterity and its antecedents and consequences are a function of heterogeneous resources and capabilities at the business unit level, rather than dependent on industry heterogeneity and cross-cultural difference. The significance of R&D strength in both samples suggests the

importance of slack resources in the pursuit of contextual ambidexterity and innovation. This result is consistent with previous studies (e.g. Judge and Blocke 2008).

Our study also has an important methodological implication. Extant literature has taken the interaction effect or the aggregation dimension of exploration and exploitation as the proxy for contextual ambidexterity (Gibson and Birkinshaw 2004; He and Wong 2005); this essentially considers exploration and exploitation as two different constructs, which is inconsistent with the theoretical proposition of a higher-order construct and likely to result in a loss of information and interpretability detrimental to data analysis (Lubatkin et al. 2006; Hughes et al. 2010). Similarly, although extant research has discussed the relevance of OD and SV to organizational ambidexterity, no prior study has examined them as components of a higher-order construct in a structural model. Our findings of the competing model (see Figure 2) clearly support this higher-order construct of 'ambidextrous organizational culture'. Future research needs to gear up methodological rigour in line with the higher-order theoretical propositions.

Finally, our study has practical implications. Companies need to adopt a bottom-up learning approach to developing organizational values and norms; such an approach to organizational culture would allow OD and SV to flourish at the same time, facilitating the integration of exploratory and exploitative activities required for developing a balanced portfolio of innovative projects. Being ambidextrous is imperative to companies' short-term performance and long-term survival. Moreover, business decision-makers should break out of the conventional view of Chinese firms' innovative capabilities, and realize that firms' exploratory and exploitative competences are results of business unit level strategy, policy and resource investment, rather than dictated by industry and country-level characteristics.

Limitations and Future Research

Despite the above contributions, our study has methodological limitations. First, albeit a common practice in international research involving data collection from China, the different data collection methods for the two samples could potentially introduce bias. Future research may provide evidence on the comparability of data collected using different techniques. Second, our study is based on cross-sectional, self-reported data from single informants which is a potential source of common method bias. While some scholars conclude that common method bias tends to be small and rarely statistically significant and that its effect on relations among variables are ‘minor at best’ (Spector 1987), others argue that common method variance could range from minimal to 25% of the variance in the measures (Bagozzi and Yi 1990). In this study, we used established measures where appropriate to improve construct validity, procedural methods to reduce evaluation apprehension, statistical methods to test the common method bias, and controlled social desirability bias. Despite these efforts, our findings should be viewed in the light of ongoing debate on potential common method bias.

Our study points to several fruitful avenues for future research. First, our research focused on organizational culture as antecedents of contextual ambidexterity whilst controlling for the UK and Chinese samples. Future study may expand our study to other cross-national samples and explicitly include national culture and organizational culture to examine their respective effects on ambidexterity. Second, our samples were drawn from high-tech industry sectors and the Chinese sample was drawn from three major developed cities with strong high-tech capacity and achievement. Further research may examine to what extent contextual ambidexterity and its antecedents and consequences are applicable in low-tech industries sectors and developing regions. Third, based on the assumption that organizational values and norms underpin processes and systems, future study may examine

the influence of ambidextrous organizational culture on Gibson and Birkinshaw's (2004) organizational context (namely performance management context and social context). Moreover, given that organizational culture also supports the integration of exploration and exploitation in structurally separated ambidexterity (Simsek et al. 2009), future research may examine the influence of ambidextrous organizational culture on Jansen et al.'s (2009) senior team integration mechanisms and organizational integration mechanisms.

CONCLUSION

We set out to conceptualize ambidextrous organizational culture and examine its relationships with contextual ambidexterity and new product innovation outcomes, and whether these relationships vary between UK and Chinese high-tech firms. Our findings reveal that OD and SV as components of a higher-order construct of ambidextrous organizational culture help integrate exploration and exploitation required for contextual ambidexterity and consequently a balanced new product innovation portfolio. Our study is the first to crystallize ambidextrous organizational culture and examine its impact on contextual ambidexterity and consequently new product innovation outcomes within a structural model, incorporating latent variables. Our findings highlight that the way to implement contextual ambidexterity is through individual involvement and participation as part of organizational culture and context, and that ambidextrous organizational culture is developed from bottom-up rather than the traditional top-down approach. Further, our findings reveal that these relationships are robust within the UK-China cross-cultural context, and most importantly, contextual ambidexterity as a distinctive organizational capability is dependent on heterogeneous resources at the business unit level (especially ambidextrous organizational culture and R&D strength), rather than industry or cross-cultural differences.

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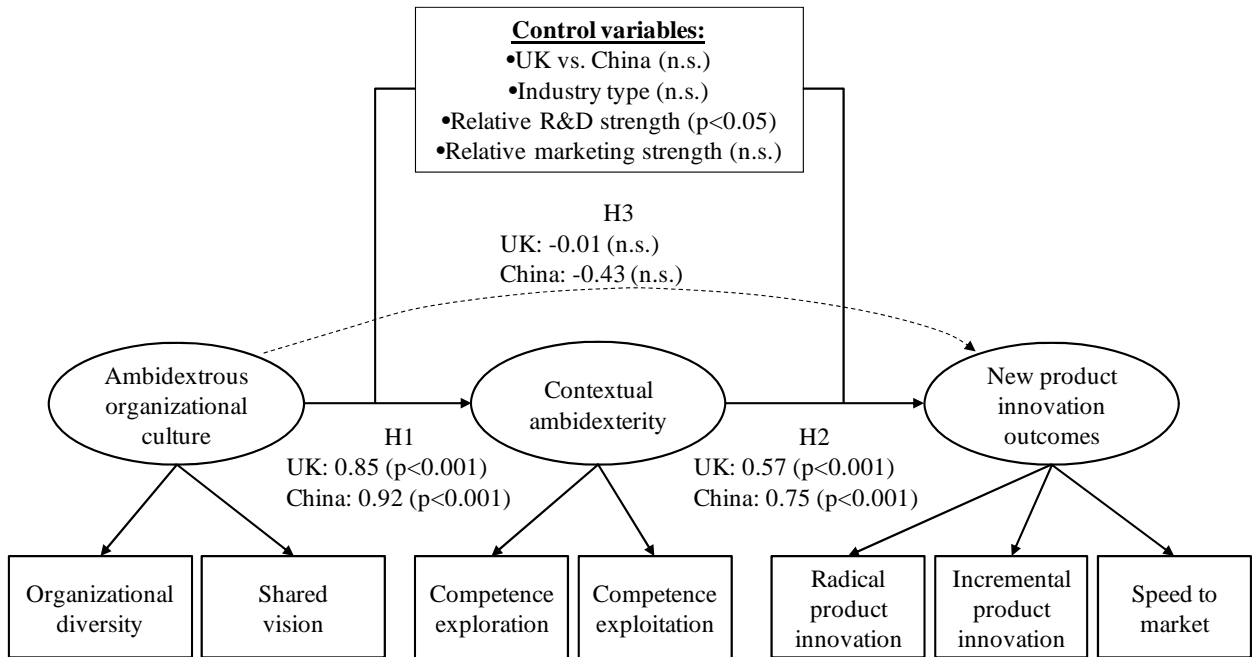
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Figure 1.

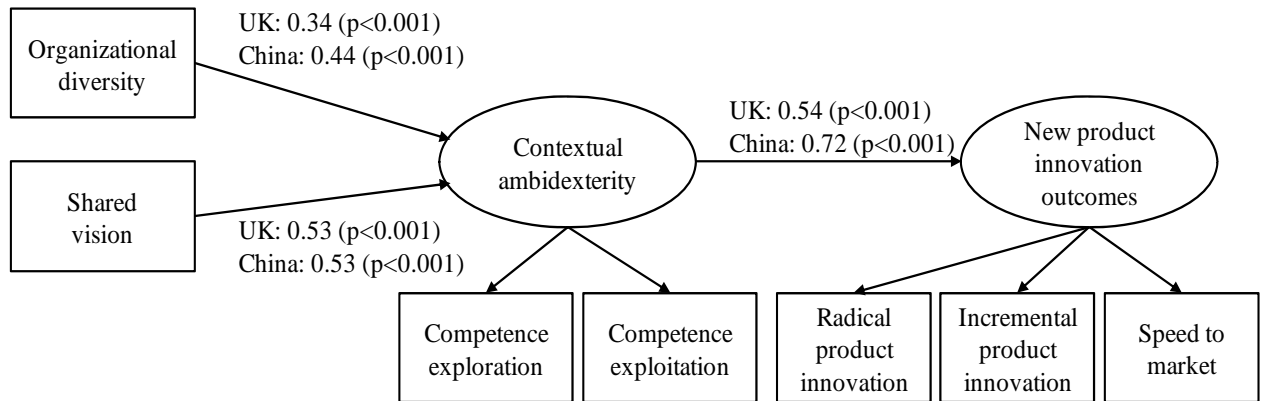
The Research Model, Hypotheses and Results



Note: Figures are standardized path coefficients with p-values in brackets.
n.s. denotes non-significant.

Figure 2.

The Competing Model



Note: Figures are standardized path coefficients with p-values in brackets.

TABLE 1.**Profiles of the UK and Chinese Samples**

| | UK (n=150) | China (n=242) |
|--|-------------------|--------------------------|
| Firm size (the number of employees): | | |
| 50-149 | 46.7% | 53.3% |
| 150-249 | 22.7% | 23.6% |
| 250-349 | 5.3% | 7.4% |
| 350-499 | 6.7% | 4.5% |
| 500-999 | 7.3% | 5.0% |
| 1000 and above | 11.3% | 6.2% |
| Firm age ¹ : | 33.4 years (29.2) | 13.0 years (10.8) |
| Industry: | | |
| Consumer electronics | 25.3% | 37.6% |
| Life sciences | 13.3% | 31% |
| ICT & emerging technologies | 61.3% | 31.4% |
| Respondent's tenure in the SBU ¹ : | 10.5 years (8.5) | 5.3 years (4.0) |
| Respondent's tenure in the industry ¹ : | 17.1 years (9.7) | 8.7 years (5.6) |
| R&D strength ² : | 6.05 (4.19) | 6.57 (5.66) ³ |
| Marketing strength ² : | 5.29 (4.17) | 6.84 (6.98) ⁴ |

Notes: (1). Figures are mean and standard deviation in brackets. (2). Figures are mean and SDR-corrected mean in brackets based on 10-point Likert scales. (3). For the purpose of multigroup analysis, the SDR-corrected mean of R&D strength of the combined sample is 5.10. (4). For the purpose of multigroup analysis, the SDR-corrected mean of marketing strength of the combined sample is 5.91.

TABLE 2.

Descriptive Statistics and Correlation Coefficients for UK and Chinese Samples

| Measure | Sample | Mean | Standard deviation | Alpha | AVE | SDB-Corrected Mean | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------------------------------|--------|------|--------------------|-------|------|--------------------|--------|--------|--------|--------|--------|--------|------|
| 1. Organizational diversity | UK | 7.57 | 1.41 | 0.75 | 0.50 | 5.85 | | 0.24 | 0.07 | 0.23 | 0.04 | 0.03 | 0.03 |
| | China | 8.10 | 1.32 | 0.73 | 0.49 | 5.15 | | 0.26 | 0.33 | 0.33 | 0.12 | 0.15 | 0.10 |
| 2. Shared vision | UK | 6.79 | 1.57 | 0.90 | 0.71 | 6.15 | 0.49** | | 0.12 | 0.27 | 0.05 | 0.08 | 0.12 |
| | China | 7.39 | 1.54 | 0.83 | 0.56 | 3.89 | 0.51** | | 0.37 | 0.37 | 0.17 | 0.16 | 0.18 |
| 3. Exploration | UK | 6.68 | 1.72 | 0.83 | 0.48 | 5.23 | 0.26** | 0.35** | | 0.11 | 0.17 | 0.06 | 0.08 |
| | China | 7.30 | 1.37 | 0.82 | 0.50 | 4.67 | 0.58** | 0.61** | | 0.64 | 0.25 | 0.23 | 0.38 |
| 4. Exploitation | UK | 7.25 | 1.28 | 0.86 | 0.57 | 5.44 | 0.48** | 0.52** | 0.47** | | 0.05 | 0.07 | 0.13 |
| | China | 7.69 | 1.23 | 0.86 | 0.56 | 4.48 | 0.58** | 0.61** | 0.80** | | 0.22 | 0.26 | 0.31 |
| 5. Radical product innovation | UK | 4.96 | 2.22 | 0.85 | 0.83 | 4.48 | 0.19* | 0.23** | 0.41** | 0.23** | | 0.28 | 0.24 |
| | China | 6.36 | 1.95 | 0.81 | 0.78 | 4.77 | 0.35** | 0.34** | 0.45** | 0.47** | | 0.26 | 0.44 |
| 6. Incremental product innovation | UK | 6.18 | 1.89 | 0.81 | 0.74 | 4.92 | 0.18* | 0.28** | 0.25** | 0.27** | 0.53** | | 0.21 |
| | China | 6.80 | 1.87 | 0.75 | 0.77 | 5.61 | 0.38** | 0.40** | 0.48** | 0.51** | 0.51** | | 0.32 |
| 7. Speed to market | UK | 5.25 | 1.61 | 0.82 | 0.53 | 5.07 | 0.18* | 0.34** | 0.28** | 0.36** | 0.49** | 0.46** | |
| | China | 6.60 | 1.61 | 0.80 | 0.48 | 5.46 | 0.32** | 0.42** | 0.62** | 0.56** | 0.66* | 0.57** | |

Notes: n (UK)=150; n (China)=242. † p <0.10; * p<0.05; ** p<0.01; *** p<0.001. Correlation coefficients are reported in the left lower diagonal half of the matrix. The shared variances are reported in the upper diagonal half of the matrix. SDB denotes 'Social Desirability Bias'. Figures are based on 10-point Likert scales. AVE is 'Average Variance Extracted'.

TABEL 3.

Results of Multigroup Analyses

| | Description¹ | x^2 | df | x^2 / df | Δx^2 and Statistical Significance⁶ | Model fit statistics |
|---|--------------------------------|-------|-----------|------------|---|--|
| Multigroup analysis by UK vs. China (n=150, 242) ² | The unconstrained model | 44.39 | 24 | 1.85 | - | GFI=0.97, CFI=0.98, RMSEA=0.05, RMR=0.12 |
| | Constrained Model A: | 45.78 | 25 | 1.83 | $\Delta x^2=1.39$, $\Delta df=1$, ns | GFI=0.97, CFI=0.98, RMSEA=0.05, RMR=0.12 |
| | Constrained Model B: | 44.39 | 25 | 1.78 | $\Delta x^2=0.00$, $\Delta df=1$, ns | GFI=0.97, CFI=0.98, RMSEA=0.05, RMR=0.12 |
| Multigroup analysis by Industry (n=129, 95, 168) ³ | The unconstrained model | 85.01 | 36 | 2.36 | - | GFI=0.94, CFI=0.96, RMSEA=0.06, RMR=0.17 |
| | Constrained Model A: | 86.32 | 38 | 2.27 | $\Delta x^2=1.31$, $\Delta df=2$, ns | GFI=0.94, CFI=0.96, RMSEA=0.06, RMR=0.17 |
| | Constrained Model B: | 89.49 | 38 | 2.36 | $\Delta x^2=4.48$, $\Delta df=2$, ns | GFI=0.94, CFI=0.95, RMSEA=0.06, RMR=0.22 |
| Multigroup analysis by R&D strength (n=181, 211) ⁴ | The unconstrained model | 65.28 | 24 | 1.85 | - | GFI=0.96, CFI=0.97, RMSEA=0.07, RMR=0.14 |
| | Constrained Model A: | 65.34 | 25 | 2.61 | $\Delta x^2=0.06$, $\Delta df=1$, ns | GFI=0.95, CFI=0.96, RMSEA=0.06, RMR=0.14 |
| | Constrained Model B: | 69.68 | 25 | 2.79 | $\Delta x^2=4.40$, $\Delta df=1$, p<0.05 | GFI=0.95, CFI=0.95, RMSEA=0.07, RMR=0.18 |
| Multigroup analysis by Marketing strength (n=169, 223) ⁵ | The unconstrained model | 52.48 | 24 | 2.19 | - | GFI=0.96, CFI=0.97, RMSEA=0.06, RMR=0.13 |
| | Constrained Model A: | 53.87 | 25 | 2.16 | $\Delta x^2=1.39$, $\Delta df=1$, ns | GFI=0.96, CFI=0.97, RMSEA=0.05, RMR=0.12 |
| | Constrained Model B: | 52.73 | 25 | 2.11 | $\Delta x^2=0.25$, $\Delta df=1$, ns | GFI=0.96, CFI=0.97, RMSEA=0.05, RMR=0.12 |

Notes: (1). The total sample size is 392. In the unconstrained model, parameters are freely estimated. In Constrained Model A, the path from ambidextrous organizational culture to contextual ambidexterity is specified as equal across groups. In Constrained Model B, the path from contextual ambidexterity to new product innovation outcomes is specified as equal across groups. (2) The sample sizes of UK and Chinese firms are 150 and 242. (3) The samples sizes of the consumer electronics, life sciences and ICT (including emerging technologies) are 129, 95, and 168. (4) The sample sizes of the low and high R&D strength groups (in relation to the mean) is 181 and 211. (5) The sample sizes of the low and high Marketing strength groups (in relation to the mean) are 169 and 223. (6) Δx^2 : difference in x^2 value between the constrained and the unconstrained models; Δdf : difference in the number of degrees of freedom between the constrained and the unconstrained models; ns: non significant.

Appendix 1 Key Constructs and Items

Organizational diversity

In this business unit ...

- (a) we respect everyone's different viewpoints.
- (b) we value people from diverse backgrounds with diverse experiences and skills.
- (c) we encourage all employees to generate as many alternative solutions to problems as possible.

Shared vision

- (a) All employees view themselves as partners in charting the direction of this business unit.
- (b) The future direction of this business unit is clearly communicated to everyone.
- (c) Everyone who works here is well aware of the long-term plans and direction of this business unit.
- (d) There is a strong sense of where this business unit is going.

Competence exploration

Over the last three years, this business unit has ...

- (a) Acquired technologies and skills entirely new to the business unit.
- (b) Learned product development skills and processes entirely new to the industry (e.g. product design, prototyping new products, timing of new product introductions, and customizing products for local markets).
- (c) Acquired entirely new managerial and organizational skills that are important for innovation (e.g. forecasting technological & customer trends; identifying emerging markets & technologies; integrating Research & Development (R&D), marketing, manufacturing & other functions; managing the product development process).
- (d) Learned new skills for the first time (e.g. funding new technology, staffing R&D function, training and development of R&D, and engineering personnel).
- (e) Strengthened innovation skills in areas where it had no prior experience.

Competence exploitation

Over the last three years, this business unit has...

- (a) Upgraded current knowledge and skills for familiar products and technologies.
- (b) Enhanced skills in exploiting well-established technologies that improve productivity of current innovation operations.
- (c) Enhanced competencies in searching for solutions to customer problems that are close to established solutions rather than completely new solutions.
- (d) Upgraded skills in product development processes in which the business unit already possessed significant experience.
- (e) Strengthened our knowledge and skills for projects that improve efficiency of existing innovation activities.

Radical product innovation

Over the past three years, this business unit has ...

- (a) Frequently introduced radically new products into markets that are totally new to the firm.
- (b) Introduced more radically new products, compared to your major competitors.

Incremental product innovation

Over the past three years, this business unit has ...

- (a) Frequently introduced incrementally new products into new markets.
- (b) Introduced more incrementally new products, compared to your major competitors.

Speed to market

Over the past three years, in this business unit...

- (a) new products have been developed and launched faster than the major competitor for a similar product.
- (b) new products have been completed in less time than what was considered normal for customary for our industry.
- (c) new products have been launched on or ahead of the original schedule developed at initial product go-ahead.
- (d) top management has been pleased with the time it took us from specifications to full commercialization.