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The interactive effects of entrepreneurial orientation and capability-based HRM on firm performance: The mediating role of innovation ambidexterity

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ABSTRACT

This paper explores critical questions about the antecedents and performance outcomes of innovation ambidexterity. Specifically, while prior research has acknowledged that entrepreneurial orientation (EO) and HRM can each influence ambidexterity, little is known about whether and how EO and HRM *interact* to affect innovation ambidexterity and whether innovation ambidexterity is a *mechanism* through which EO and HRM together contribute to firm performance. Building on the dynamic capability view of ambidexterity and the interplay of EO and HRM, we propose that (1) the interaction between EO and capability-based HRM facilitates innovation ambidexterity, and (2) its relationship with firm performance is mediated by innovation ambidexterity. A sample of 264 industrial firms from China is used to test our theoretical model. The results provide support for the significant effects of the interaction between EO and capability-based HRM on innovation ambidexterity. Further, the results suggest innovation ambidexterity acts as an effective mechanism through which EO and capability-based HRM together contribute to firm performance. The theoretical and managerial implications of our findings are also discussed.

1. Introduction

Operating in changing environments requires firms to explore new knowledge and resources needed for radical innovation while simultaneously exploiting existing knowledge and resources to enable incremental innovation (Andriopoulos & Lewis, 2009; He & Wong, 2004). Innovation ambidexterity is an emerging concept which captures the management of these dual endeavors; its importance stemming from its influence on firm superior performance (Gibson & Birkinshaw, 2004; He & Wong, 2004) and market success (Atuahene-Gima, 2005; O'Cass, Heirati, & Ngo, 2014). Conceptualized as a firm's ability to simultaneously reconfigure new resources leading to discontinuous innovations (exploration) and to refine existing resources leading to incremental innovations (exploitation) in a balanced way (He & Wong, 2004; Kortmann, 2014; Lin, McDonough, Lin, & Lin, 2013; March, 1991), innovation ambidexterity is, however, difficult to develop and implement in practice. This is because, for exploration and exploitation to be achieved, it requires the management of inherent differences in the firm's underlying resources and assets (March, 1991), strategic orientations (Kortmann, 2014), and entrepreneurial processes (Mihalache, Jansen, Van Den Bosch, & Volberda, 2014). Emphasizing this nuanced complexity, March (1991: 85) explains "the essence of exploration is experimentation with new alternatives", whereas "the essence of exploitation is the refinement and extension of existing competences, technologies, and paradigm". Alongside this complexity, the performance outcomes of innovation ambidexterity remain inconclusive as is evidenced by findings indicating positive (e.g., Fernhaber & Patel, 2012), negative (e.g., Lavie, Kang, & Rosenkopf, 2011) and insignificant (e.g., Venkatraman, Lee, & Iyer, 2007) performance effects.

Recent work suggests that two lines of inquiry hold potential for developing our understanding of how firms pursue exploration and exploitation and consequently benefit from innovation ambidexterity. The first line highlights the role of strategic orientations as guiding principles that influence decision-making styles, strategy implementations and business operations (e.g., Kortmann, 2014); while the second line relates to intellectual capital, and in particular how HRM practices can be antecedents of exploration and exploitation (e.g., Kang & Snell, 2009).

Strategic orientations refer to "the strategic directions implemented by a firm to create the proper behaviours for the continuous superior performance of the business" (Gatignon & Xuereb, 1997: 78). These orientations drive the business operations that underpin a firm's innovation decision-making and activities (Noble, Sinha, & Kumar, 2002; Zhou, Yim, & Tse, 2005). Recent studies suggest strategic orientations are critical not only for firms to convert strategic decisions into innovation ambidexterity (Kortmann, 2014), but also for moderating the relationship of ambidextrous activities (such as exploration and exploitation alliances) with performance (Yamakawa, Yang, & Lin, 2011).

Although scholarly attention has highlighted the importance of a number of different types of orientations as antecedents of innovation:

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e.g., market orientation (MO) (e.g., Morgan & Berthon, 2008); learning orientation (LO) (e.g., Calantone, Cavusgil, & Zhao, 2002); and technology orientation (TO) (Hult, Hurley, & Knight, 2004), it seems that entrepreneurial orientation (EO) is the essence of innovation ambidexterity and its performance outcomes. Prior research has accentuated EO as a widely accepted and fundamental antecedent for achieving innovation success (Lisboa, Skarmeas, & Lages, 2011; Zhou et al., 2005) and for capturing firm performance (Rauch, Wiklund, Lumpkin, & Frese, 2009). More importantly, EO reflects a firm's decision-making styles, principles, processes and practices that guide both opportunity-seeking (exploration) and advantage-seeking (exploitation) activities (Boso, Story, & Cadogan, 2013; Hult & Ketchen, 2001; Lisboa et al., 2011; Lumpkin & Dess, 1996; Sirén, Kohtamäki, & Kuckertz, 2012). This positions EO as an appropriate lens to understand innovation ambidexterity, particularly given that market, learning and technology orientations are less likely to capture both forms of innovation. For example, MO is most likely to result in exploitative innovations and overlook explorative innovations (Morgan & Berthon, 2008), while learning (Morgan & Berthon, 2008) and technology orientations (e.g., Sainio, Ritala, & Hurmelinna-Laukkanen, 2012) are more likely to explain explorative innovations (Cheng & Huizingh, 2014; Hakala, 2011). In addition, the combination of exploration and exploitation is better achieved through entrepreneurial orientations or activities as ambidexterity, by definition, is conceived as a facet of entrepreneurship (Kollmann & Stöckmann, 2012; Lumpkin & Dess, 2001). However, research on how EO facilitates innovation ambidexterity and how this is linked to firm performance (Lisboa et al., 2011), as well as to what extent EO might be combined with other strategic orientations and organizational attributes to generate competitive advantage (Boso et al., 2013), remains underexplored in the literature.

The ambidexterity literature has long been dominated by temporal, structural, contextual and system views of ambidexterity (e.g. Gibson & Birkinshaw, 2004; Patel, Messersmith, & Lepak, 2013). However, a recent stream of research has increasingly recognized that firms also draw on intellectual capital (organizational, social and human capital) to make decisions on pursuing ambidexterity, especially with regards to integrating the knowledge for exploration and exploitation (Kang & Snell, 2009; Kang, Snell, & Swart, 2012; Turner, Swart, & Maylor, 2013). The intellectual capital perspective suggests that human resource management (HRM) systems "encompass social relationships and organizational processes" resulting in the achievement of ambidexterity (Kang et al., 2012: 462). In other words, HRM is not only "the primary means by which firms can influence and shape the skills, attitudes and behavior of individuals" (Chen & Huang, 2009: 104), it also creates a supportive organizational structure and environment in which firms can develop knowledge and resources for both exploration and exploitation (Patel et al., 2013; Turner et al., 2013). Moreover, human resource capabilities (i.e., the skills, knowledge and behaviors of employees developed by the HRM system) are considered in RBV contributions to be among the most important *resources* that a firm can utilize to develop its innovation potential and contribute to firm performance (Colbert, 2004; Wright, Dunford, & Snell, 2001). However, even though the importance of HRM for ambidexterity has been acknowledged (Patel et al., 2013), it remains unclear how HRM might affect ambidexterity including innovation ambidexterity and, in turn, shape the relationship with firm performance (Jiang, Takeuchi, & Lepak, 2013; Kostopoulos, Bozionelos, & Syrigos, 2015).

Conceptually, building on the dynamic capability perspective and the RBV, innovation ambidexterity has its emphasis on the outcomes of synergizing different resources and the dynamism of resource reconfiguration, while the RBV focuses on a firm's specific resources (e.g. Bodwell & Chermack, 2010; Eisenhardt & Martin, 2000; He & Wong, 2004; Menguc & Auh, 2008). To date, however, we still lack understanding about how resources related to key organizational attributes, such as EO and HRM, might be combined to generate innovation ambidexterity (Jansen, Simsek, & Cao, 2012), and in turn lead to superior firm performance.

To address these interesting issues we have developed a framework to investigate how EO and HRM facilitate innovation ambidexterity and subsequently enhance firm performance. This work contributes to the literature in at least two ways. First, we adopt an interactive perspective on the antecedents of innovation ambidexterity by shifting our focus from the *singular* effects of different antecedents to the *interactive* effects of the interplay between EO and HRM. We argue that the specific interaction between EO and HRM fosters innovation ambidexterity. This interactive perspective enriches the literature which calls for more research into how EO (e.g., Lisboa et al., 2011) and HRM (e.g., Kang et al., 2012) are linked to ambidexterity and, additionally, provide new insights into whether and how organizational resources and practices (i.e., EO and HRM in this study) are combined in order to achieve exploration and exploitation simultaneously (He & Wong, 2004).

Second, although a body of research acknowledges the importance of both EO and HRM on firm performance, our research extends this literature by demonstrating the mediating effect of innovation ambidexterity. Both the EO and HRM literatures call for more research analyzing the mediating components in the link of EO and HRM with firm performance. Importantly, our research also offers extensions to prior studies which examine the EO-ambidexterity-performance (e.g., Kollmann & Stöckmann, 2012) or HRM-ambidexterity-performance relationship (e.g., Patel et al., 2013), by arguing that the interaction of EO and HRM contributes to firm performance through innovation ambidexterity.

The remainder of this paper is organized as follows. The next section presents the theoretical basis and hypothesis development. In the methods section, we introduce our research setting and describe research methods. Next, we present the results of our hypotheses testing. The paper ends with a discussion of our findings, key conclusions, and suggestions for future research.

2. Theory and hypothesis development

2.1. Innovation ambidexterity and firm performance

Ambidexterity refers to the ability to simultaneously pursue two things, such as exploration and exploitation, efficiency and flexibility, or alignment and adaptability (De Clercq, Thongpapanl, & Dimov, 2013). The resource and capability perspective conceptualizes innovation as a complex and dynamic process through which firms consistently develop innovation capabilities by exploring new resources or exploiting new combinations of resources (e.g. Galunic & Rodan, 1998; Mahoney & Pandian, 1992; Teece, Pisano, & Shuen, 1997). Building on these perspectives, innovation ambidexterity is portrayed as a firm's ability to concurrently develop explorative and exploitative capabilities for both radical and incremental innovation (Fernhaber & Patel, 2012; He & Wong, 2004; Lin et al., 2013; Tushman & O'Reilly, 1996). Explorative capability refers to a firm's ability to acquire, develop and apply new technological knowledge, resources and skills in innovation; whereas exploitative capability refers to a firm's ability to refine and develop new uses for existing knowledge, resources and skills that facilitate the consistent improvement in innovation (see also Atuahene-Gima, 2005; He & Wong, 2004; Lisboa et al., 2011; March, 1991; Yalcinkaya, Calantone, & Griffith, 2007).

Scholars have also characterized ambidexterity as a form of dynamic capability (Jansen, Tempelaar, & Van den Bosch, 2009; O'Reilly & Tushman, 2008; Zimmermann, Raisch, & Birkinshaw, 2015). Dynamic capabilities refer to a firm's ability to "integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al., 1997: 516). The dynamic capability perspective of ambidexterity therefore emphasizes the routines and processes that enable the firm to "reconfigure existing organizational assets and competencies in a repeatable way to adapt to changing circumstances…" and

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"orchestrate the complex trade-offs that ambidexterity requires" (O'Reilly & Tushman, 2008: 200).

From this we can see that innovation ambidexterity shares a number of features with dynamic capabilities. First, explorative and exploitative innovations require substantially different sets of strategic orientations, technological resources, and processes. Consistent with the dynamic capability notion of integrating and recombining distinct competences, innovation ambidexterity provides a mechanism to effectively manage the shift between explorative and exploitative activities (Zimmermann et al., 2015) and to repeatedly pursue and achieve both radical and incremental innovation (Andriopoulos & Lewis, 2009; Jansen et al., 2009).

Second, similar to the dynamic capability perspective, innovation ambidexterity captures how firms respond to and shape environmental opportunities by simultaneously pursuing complementary forms of innovation. For example, because explorative innovation has higher sunk costs and risks, firms pursuing this type of innovation will also look to benefit from the efficient use of existing resources (Katila & Ahuja, 2002) as well as improvements in existing operations (Helfat & Winter, 2011). In contrast, firms pursuing exploitative innovation will simultaneously explore knowledge variants and develop new capabilities to "replace inefficient capabilities with more efficient ones" (He & Wong, 2004; Sirmon, Hitt, Ireland, & Gilbert, 2011: 1402) in order to seek out future technology and market opportunities. Thus, innovation ambidexterity forms a dynamic path to innovation (He & Wong, 2004; Raisch, Birkinshaw, Probst, & Tushman, 2009) and its value is determined by the same conditions of dynamic capabilities (Andriopoulos & Lewis, 2009; O'Reilly & Tushman, 2008).

In sum, because innovation ambidexterity makes it difficult for competitors to detect the focal firm's innovation process (O'Reilly & Tushman, 2008), it helps firms improve both the effectiveness and the efficiency of innovation, consequently contributing to superior firm performance (Atuahene-Gima, 2005; Li & Huang, 2012; Tushman & O'Reilly, 1996). We next turn our attention to how EO and capability-based HRM can develop our understanding of how firms pursue innovation ambidexterity.

2.2. EO and innovation ambidexterity

EO refers to a firm's strategic posture that reflects innovativeness, proactiveness and risking-taking (Covin & Slevin, 1989; Lumpkin & Dess, 1996; Miller, 1983). It also refers to the decision-making activities, processes and practices that guide a firm to explore and exploit new market opportunities (Lumpkin & Dess, 1996). Specifically, innovativeness reflects a firm's tendency and ability to create new ideas, support creativity and novelty and conduct R&D in developing new products and processes (Lumpkin & Dess, 1996). Proactiveness is defined as a firm's willingness to anticipate and act on future market demands and needs, and to introduce new products, processes and services ahead of its competitors to shape future demand and opportunities (Lumpkin & Dess, 1996). Risk-taking refers to a firm's willingness to "take bold actions by venturing into the unknown, borrowing heavily, and/or committing significant resources to ventures in uncertain environments" (Rauch et al., 2009: 763). Given these characteristics of EO, we propose that EO is more significantly associated with innovation ambidexterity for several reasons.

First, by the definition of EO, entrepreneurial-oriented activities comprise both effectively generating new market opportunities (exploration) and efficiently refining existing resources in organizational operations to maintain existing opportunities (exploitation) (Arend, 2014; Kollmann & Stöckmann, 2012). In other words, EO helps firms "form a balance between *opportunity-seeking* (i.e., exploration) and *advantage-seeking* (i.e., exploitation) behaviors" (Ireland & Webb, 2007: 50) which in turn can generate effective innovation (e.g., Zhou et al., 2005). Firms with strong EO are therefore more likely to pursue both explorative and exploitative innovation as they adapt to, and shape the market environment (Hult & Ketchen, 2001; Wiklund & Shepherd, 2003). An emphasis on exploration alone, with little attention on exploitation, makes innovation activities more costly and risky, reducing the benefits associated with exploiting existing capabilities. Conversely, a singular focus on exploitation may provide short-term benefits but will also compromise or deny opportunities for future development (Chen, Li, & Evans, 2012; Mihalache et al., 2014).

Second, the ambidexterity literature suggests that ambidexterity, including innovation ambidexterity, is a type of dynamic capability (O'Reilly & Tushman, 2008; Zhan & Chen, 2013) as the development of dynamic capabilities is based on both exploitative and exploratory activities (Benner & Tushman, 2003). This leads to an interesting question about how innovation ambidexterity, as a dynamic capability, comes to exist. Prior research in this area suggests that the development of dynamic capabilities starts from EO and entrepreneurial processes in which firms recombine their "substantive capabilities" and "organizational knowledge" to facilitate the integration of capabilities (Zahra, Sapienza, & Davidsson, 2006). Further, more recent research describes how EO shapes the organizational structure to create an adhocracy philosophy and culture that enhances a firm's ability to, not only, develop new knowledge and resources, but also to undertake constant improvements of existing knowledge and resources (Chen et al., 2012).

Thus, for reasons outlined in the preceding discussions, it is argued here that EO is likely to be influential in fostering innovation ambidexterity as it permits firms to orchestrate and redeploy organizational resources to both explorative and exploitative innovation (Arend, 2014; Ireland, Hitt, & Sirmon, 2003; Sirmon et al., 2011). This line of inquiry is quite timely as, despite its apparent close association with innovation ambidexterity, the relationship between EO and exploitative and explorative capabilities remains under-investigated (Lisboa et al., 2011).

2.3. Capability-based HRM and innovation ambidexterity

Prior research suggests that HRM can be grouped into three domains: ability-, motivation- and opportunity-oriented HRM (Prieto & Santana, 2012). Drawing on the strategic HRM literature, we focus on the capability oriented approach to HRM, which we hereinafter refer to as *capability-based HRM*. We conceptualize this capability-based HRM as a set of people management strategies and activities that enable employees to develop their skills and knowledge and ultimately contribute to competitive advantage (Way, 2002). We focus on the capability-based domain of HRM for two reasons. First, as outlined in the RBV, firm capabilities related to HRM contribute most to innovation and firm performance (Colbert, 2004; Wright et al., 2001). Second, prior research argues that compared with motivation- and opportunity-based HRM, capability-based HRM is more effective in shaping organizational social climates (including those formed from EO) and has a stronger effect on ambidexterity (Prieto & Santana, 2012).

It is argued that capability-based HRM fosters an organizational context that could be effective for exploration and exploitation by focusing on capability-based: (1) recruitment/selection, (2) participation, and (3) learning mechanisms. First, to develop a supportive structure for ambidexterity, it is important that capability-based recruitment practices select and maintain individuals with an ability to explore new knowledge and improve existing knowledge. Selecting individuals who share knowledge (Gibson & Birkinshaw, 2004) will also enhance both forms of innovation activities given their inherent dependence on old, refined and new knowledge. Thus, consistent with the premise of strategic HRM, capability-based recruitment practices need to ensure that there is a close alignment between the abilities of individuals and the firm's innovation activities or norms (Mäkelä, Sumelius, Höglund, & Ahlvik, 2012).

Second, capability-based participatory schemes, such as team work, autonomy in the work process, team briefing sessions and suggestion schemes, may prompt employees to expend effort towards fulfilling work objectives and contributing to the firm's strategic activities. Increased autonomy may encourage individuals to experiment in their

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work (Kang & Snell, 2009) which is conducive to both knowledge refinement and new knowledge creation. Specifically, initiatives aimed at encouraging capability-based participation serve to strengthen this connection by enhancing employees' self-motivation to engage in explorative and exploitative activities (Ceylan, 2013; Kang et al., 2012).

Third, learning is at the heart of innovation ambidexterity as exploration also "refers to learning and innovation (i.e., the pursuit and acquisition of new knowledge)" and exploitation refers to "the pursuit and acquisition of new knowledge, albeit a different kind than that associated with exploration"; with a distinguishing feature between exploration and exploitation being "the amount of learning" (Gupta, Smith, & Shalley, 2006, pp. 693–694). Learning mechanisms are established via a flexible training system. This system fosters an organizational context in which employees are exposed to a variety of opportunities for capability and skill development that allow them to engage in both exploration and exploitation (Kostopoulos et al., 2015). Employee's learning agility, in conjunction with their multiskilling capabilities, facilitates a firm's HRM flexibility. It is this dynamic capability that contributes to the simultaneous pursuit of exploration and exploitation (Kang et al., 2012). Based on these ideas, we suggest that capability-based HRM will foster a supportive context for innovation ambidexterity by developing, among the workforce, capabilities to align and adapt the firm's innovation activities.

Beyond the direct relationship of EO and capability-based HRM with innovation ambidexterity discussed above, as shown in Fig. 1, we further develop a conceptual framework to investigate the interactive and mediating relationships between EO, capability-based HRM, innovation ambidexterity, and firm performance.

2.4. Hypotheses

2.4.1. The interactive effect of EO and capability-based HRM on innovation ambidexterity

The aforementioned discussion has highlighted how innovation ambidexterity can be directly linked to both EO and capability-based HRM. Interestingly, both the entrepreneurship and strategic HRM literatures also suggest that entrepreneurship may benefit from interactions with HRM, and by extension enhance innovation and competitive advantage (Nasution, Mavondo, Matanda, & Ndubisi, 2011; Schmelter, Mauer, Börsch, & Brettel, 2010). EO is a critical element of entrepreneurship (Dess & Lumpkin, 2005). Innovation and wealth creation are most likely to be associated with EO when firms utilize human resources that enable them to pursue opportunities and advantages (Ireland et al., 2003). This is because it is people rather than products that are the most important assets of entrepreneurial firms (Gupta & Singhal, 1993). Thus HRM activities that develop and mobilize the workforce are likely to be critical in facilitating EO interactions (Hayton, 2005). Further, HRM activities can be designed to promote the creation, transfer and implementation of knowledge that shapes organizational learning embedded within EO (Hayton, 2005) and where this occurs, "[employees will] develop the confidence and skills to put forward novel proposals designed to improve work operation … be better equipped as a result of these activities to promote product innovation, as well as innovation in product technology" (Shipton, Fay, West, Patterson, & Birdi, 2005: 126). Recent empirical research (e.g. Messersmith & Wales, 2013; Tang, Chen, & Jin, 2015) finds that the relationship between EO and innovation performance is stronger in those firms which have implemented strategic HRM to a greater extent.

Moreover, the synergy perspective of RBV argues that alongside of the direct effects, the interactive impacts of resources should be examined (Barney, Wright, & Ketchen, 2001). EO influences "how a firm is organized in order to discover and exploit opportunities" (Wiklund & Shepherd, 2003: 1310). Building on this view, firms with high levels EO are more likely to combine their entrepreneurial mind-set with their capability-based HRM in a *supplementary* way by creating an organizational adhocracy in which individual's knowledge and skills are amplified and directed towards the development of both radical and incremental innovation (Lumpkin & Dess, 1996), the acquisition and application of greater market information (Chen et al., 2012), and the embracement of uncertain outcomes of new market entry (Lisboa et al., 2011). Additionally, firms with higher levels of EO are also more likely to benefit from combining capability-based HRM in a *complementary* way, whereby innovation-oriented selection, staffing and training initiatives are applied in such a way that new and existing employees' knowledge and skills are expanded towards exploring new products and exploiting more entrepreneurial and market opportunities (Messersmith & Wales, 2013; Tang et al., 2015).

Further, EO, as a firm's intangible asset, will not automatically lead to innovation (Kollmann & Stöckmann, 2012; Wiklund & Shepherd, 2003). This means firms need to link their employees' knowledge and skills to its entrepreneurial beliefs. They do this through use of a HRM system which has been specifically designed with the objective of mobilizing the firm's entrepreneurial values. In other words, HRM is the mechanism which helps firms to match their employees' abilities with their strategic objectives (Tang et al., 2015). To illustrate, staffing and selection with the strategic purpose of innovation may direct employees' attitudes and behaviors to the desired strategic objective of innovation (Lopez-Cabrales, Pérez-Luño, & Cabrera, 2009; Paauwe & Boselie, 2005) by focusing on evaluating the best fit of employees' knowledge, skills and abilities to entrepreneurial activities. In this scenario, capability-focused staffing and selective procedures would encourage employees to be more cognizant of the need to engage in creative thinking and innovativeness (Atuahene-Gima, 1996; Chen & Huang, 2009; Kang et al., 2012). Thus, where HRM activities have the purpose of strategically aligning the knowledge, skills and learning abilities of its employees, the firm's resource flexibility is improved (Lepak, Takeuchi, & Snell, 2003; Wright & Snell, 1998) and so too are the firm's risk-taking abilities. Prior research has shown that resource flexibility facilitates

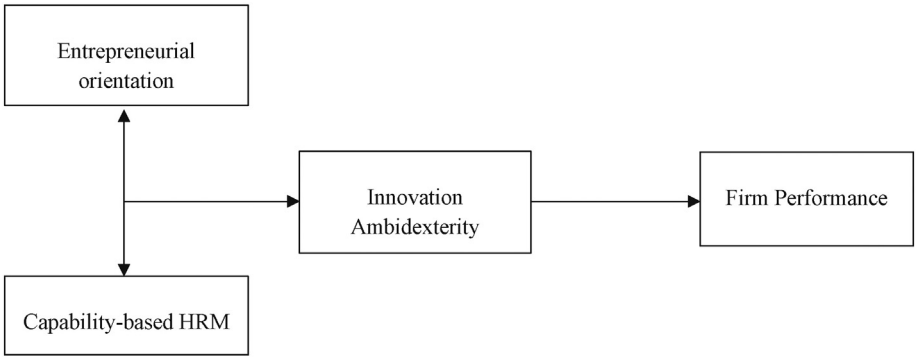

Fig. 1. Conceptual model.

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the firm's innovativeness (Chang, Gong, Way, & Jia, 2013) and creates a resource base capable of simultaneously exploiting new combinations of existing knowledge and opportunities, and exploring new knowledge and innovative solutions (Kang et al., 2012; Patel et al., 2013; Wright & Snell, 1998). A few empirical studies have shown a positive link for the interaction between entrepreneurship and HRM with innovation (e.g., Nasution et al., 2011). In sum, we argue that EO aligned with capability-based HRM facilitates innovation ambidexterity:

H1. The interaction of EO and capability-based HRM is positively associated with innovation ambidexterity.

2.4.2. The mediating effect of innovation ambidexterity

Prior research suggests ambidexterity may be one of the mediating factors that link both EO (Kollmann & Stöckmann, 2012) and HRM (Patel et al., 2013) to firm performance. Moreover, although scholars have examined the mediating effect of innovation ambidexterity on the relationship between firm performance and a number of organizational attributes such as learning (Lin et al., 2013), competitive strategy (Hughes, Martin, Morgan, & Robson, 2010) and proficiency in product development (Li & Huang, 2012), little research has been done to investigate how EO and capability-based HRM interactions contribute to firm performance through innovation ambidexterity. Consequently, we hypothesize that innovation ambidexterity will have a mediating effect on the relationship of the interaction between EO and capability-based HRM with firm performance.

Ambidexterity including innovation ambidexterity plays an important role in ensuring that organizational attributes (such as prior and new routines and resources) result in performance improvements (e.g. Gibson & Birkinshaw, 2004; Li & Huang, 2012). This is because resources arising from organizational contexts (such as the interaction of EO and HRM) are only basic *factors* that provide opportunities for a firm to produce radical and incremental innovation activities and improve performance (Christensen, 1995). According to the RBV, organizational resources lead to superior performance only if they are effectively combined to become a rare and inimitable capability (Barney, 1991).

Based on this logic, the interaction between EO and HRM provides firms with a supportive organizational attribute to integrate and transfer innovation resources. Again although the context itself is necessary, it might not be sufficient to generate direct effects on firm superior performance (Patel et al., 2013). For example, many entrepreneurial firms use capability-based HRM practices, but not every firm can benefit from these practices because of the lack of development of valuable and inimitable capabilities (Colbert, 2004). Innovation ambidexterity enables firms to pursue a new combination of innovation resources (Hill & Birkinshaw, 2014) arising from different organizational attributes. This combination effect can reduce the costs of complex product portfolios by offsetting the tendency to solely develop one type of resource, in turn, contributing to both short-term and long-term performance outcomes (Fernhaber & Patel, 2012).

In addition, consistent with the dynamic capability perspective, innovation ambidexterity gradually develops over time (Hill & Birkinshaw, 2014; Li & Huang, 2012; O'Reilly & Tushman, 2008). This suggests that there might not be an immediate effect from EO and capability-based HRM interactions. Rather, firms take time to direct individual's behavior to explorative and exploitative innovation activities, and must also create an organizational attribute over time that enables firms to consistently facilitate the development of new innovation resources and leverage the use existing innovation resources. It is only then, following this *path-dependent process* (Hill & Birkinshaw, 2014), that firms can generate actual outcomes in the form of innovation ambidexterity from these activities. It is this innovation ambidexterity that is most likely to directly contribute to superior performance. We therefore argue that innovation ambidexterity is a valued mechanism through which the interaction of EO and capability-based HRM influences firm superior performance over time. We accordingly propose:

H2. Innovation ambidexterity mediates the relationship of the interaction between EO and capability-based HRM with firm performance.

3. Methods

3.1. Sample and data collection

To test our hypotheses we used data generated by a questionnaire survey administered under a comprehensive research project granted by the National Natural Science Foundation of China in 2012.[1] The sampling frame of this study consisted of a list of firms from a part of the annual industrial enterprises statistics provided by the Statistical Bureau of China. We then utilized a random sampling method to choose 1000 firms from the list. Our random sample covered a broad range of industries such as chemicals, computer and information technology, consumer electronics, and food and beverages, and included SOEs, private firms, and joint ventures. Members of the research team contacted senior managers who are CEOs, vice-presidents or managers with a title of director or department head, to ensure that the respondents were knowledgeable about their firm's innovation activities, to request participation.

The questionnaire was developed and refined on the basis of several procedures. First, a draft of the questionnaire was developed and then we conducted structured in-depth interviews with 10 senior managers in Harbin and Shenzhen. Second, based on the literature review and preliminary interviews, we designed a full version of the questionnaire and carried out a back-translation procedure to ensure the conceptual equivalence of the English and Chinese versions of the questionnaire. Third, prior to sending the survey, we conducted a pilot survey with senior or middle R&D and technology managers in 16 industrial firms to identify ambiguities in the survey questions and improve the clarity of concepts. Finally, the questionnaire was refined and finalized on the basis of the feedback and results of the pre-test with additional back-translation to confirm the equivalence of all changes.

Following Dillman's (2000) total design method, a package containing the questionnaire along with a cover letter that explained the purpose of the research, was distributed via postal mail, email or in person to targeted managers from those 1000 randomly selected industrial firms in Beijing, Guangdong, Shanghai, and Harbin. Targeted managers were also asked to forward the questionnaire to the best qualified person in the firm to answer if they were unable to answer the questionnaire. A reminder letter and an additional copy of the questionnaire were sent out to non-respondents six weeks after the initial mailing. Three weeks after the second mailing, we contacted those who had not responded. In the end, the final data set included 264 usable questionnaires from 276 returned questionnaires (12 were excluded because of a large number of incomplete data on key items). Table 1 presents the profiles of the sample.

In order to check for the possibility of non-response bias, we compared early and late respondents in terms of the number of years of establishment, the number of full-time employees and the number of business and product types. The results of a t-test were insignificant ($p > 0.10$), indicating that in this study, non-response bias was not a significant problem (Armstrong & Overton, 1977).

[1] This study is one of the subprojects of a comprehensive research project titled "Study of the integrated organizational management system: learning and changing mechanisms under complex and dynamic environment in China" (No.: 71121001, 01), granted by National Natural Science Foundation of China.

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Table 1
Profiles of the sample.

	N = 264	
Firm size	Frequency	%
1–49 employees	38	14.4
50–149 employees	38	14.4
150–499 employees	35	13.3
500–999 employees	27	10.2
1000 and above	126	47.7
Firm age[a] (years)	17.5 (15.8)	
Ownership		
SOEs	102	38.6
Private firms	94	35.6
IJVs	21	7.6
Wholly-owned foreign companies	35	13.3
Others (collective firms etc.)	9	3.4
Industry		
Chemicals	19	7.2
Computer and IT	39	14.7
Consumer electronics	32	12.1
Electricity	25	9.4
Foods and beverage	31	10.6
Furniture	17	6.4
Machinery and transport devices	23	8.7
Telecommunications	33	12.5
Textiles	32	12.2
Other manufacturing	13	4.9
Location		
Beijing	121	45.8
Guangdong	51	19.3
Harbin	35	13.3
Shanghai	57	21.6
Number of business types		
One type	71	26.9
Two types	38	14.4
Three types	45	17.0
Four types	19	7.2
Five or more types	91	34.5

[a] Mean and standard deviation in parentheses.

3.2. Measures

Firm performance was measured by seven items modified from prior research. The respondents were asked to assess their firm's performance such as sales growth, return on investments and market share growth, relative to their main competitors, over the last three years using a seven-point Likert scale (1 = much worse, 7 = much better) ($\alpha = 0.90$).

Innovation ambidexterity refers to a firm's ability to simultaneously pursue exploration and exploitation in a balanced and a trade-off way (Cao, Gedajlovic, & Zhang, 2009; Li & Huang, 2012; Menguc & Auh, 2008; Rothaermel & Alexandre, 2009). While there is no widely accepted operationalization for ambidexterity (Lubatkin, Simsek, Ling, & Veiga, 2006), the conceptualization of ambidexterity provides some basic ideas for informing its operationalization. By this definition, while exploration and exploitation are two conceptual components underpinning ambidexterity, this does not necessarily require ambidexterity to entail the equal enactment of both exploration and exploitation within the same time frame (Kortmann, 2014; Lin et al., 2013) and exploration versus exploitation is a broad concept (Fernhaber & Patel, 2012; He & Wong, 2004). They should firstly be measured independently. Moreover, as exploration and exploitation are orthogonal, they should then be combined to form a single index for ambidexterity. To develop an appropriate operationalization for innovation ambidexterity, following prior research (e.g. Halevi, Carmeli, & Brueller, 2015; He & Wong, 2004; Jansen et al., 2009; Lubatkin et al., 2006), we employed a two-step approach to measure innovation ambidexterity.

First, we measured explorative and exploitative capability separately with items used for, or modified from, prior research (e.g. He & Wong, 2004; Hernández-Espallardo, Sánchez-Pérez, & Segovia-López, 2011; Hughes et al., 2010; Lisboa et al., 2011; Lubatkin et al., 2006; Yalcinkaya et al., 2007). Five items measuring explorative capability reflect the firm's ability to learn and acquire knowledge, technology and skills, product development, management and markets entirely new to the firm ($\alpha = 0.88$). Six items used to measure exploitative capability tap the firm's ability to improve attributes and quality of products and processes, enhance knowledge and skills in exploiting resources and technologies, speed up product and process upgrading, enhance core competences and upgrade current knowledge and skills for familiar products, processes and operations ($\alpha = 0.92$). Each respondent was asked to rate his or her firm's abilities relative to its major competitors over the last three years using a seven-point Likert scale (1 = much weaker, 7 = much stronger).

Second, we combined the measures of explorative and exploitative capability. Prior research has suggested a diverse range of measures for combining exploration and exploitation including the additive approach (exploration + exploitation) (e.g. Blindenbach-Driessen & van den Ende, 2014; Halevi et al., 2015; Hughes et al., 2010; Jansen et al., 2009; Lubatkin et al., 2006), multiplicative approach (exploration × exploitation) (e.g., Cao et al., 2009; Jansen et al., 2012) and subtractive approach (|exploration − exploitation|) (e.g. Cao et al., 2009; He & Wong, 2004). The additive approach reflects the total level of ambidexterity (Blindenbach-Driessen & van den Ende, 2014; Fernhaber & Patel, 2012; Hill & Birkinshaw, 2014; Patel et al., 2013) in terms of the summarized magnitudes of exploration and exploitation (e.g., Lubatkin et al., 2006). The multiplicative approach focuses on the interaction of exploration and exploitation (e.g. Cao et al., 2009; Hill & Birkinshaw, 2014; Jansen et al., 2012), while the subtractive approach emphasizes the congruence of exploration and exploitation (e.g. Cao et al., 2009; Patel et al., 2013). Each approach reflects a particular theoretical treatment of ambidexterity. Moreover, the general challenge is when combining two measures to form a single index, information about the unique contribution of each component to the newly combined index could be lost (Edwards, 1994; Lubatkin et al., 2006).

To determine which approach forms the most interpretable index and loses the least information concerning the unique contribution of exploration and exploitation to their combined index (e.g. Jansen et al., 2009; Lubatkin et al., 2006), we followed Edwards (1994) test recommended by prior ambidexterity research (Halevi et al., 2015; Jansen et al., 2009; Lubatkin et al., 2006; Prieto & Santana, 2012). Specifically, in line with prior research, we ran five regression analyses with firm performance as a dependent variable given that ambidexterity has a significant relationship with firm performance (e.g., Jansen et al., 2009).

The first model separated exploration and exploitation as two independent variables. The second to fifth models used the additive, subtractive, multiplied and divided item of exploration and exploitation as a single independent variable respectively. Compared with the first model ($R^2 = 0.12$, $F = 18.07$, $p < 0.001$; exploration: $\beta = 0.17$, $p < 0.05$; exploitation: $\beta = 0.21$, $p < 0.05$), the additive model ($R^2 = 0.16$, $F = 36.2$, $p < 0.001$; exploration + exploitation: $\beta = 0.35$, $p < 0.001$) represented similar effects of ambidexterity and was more significant than the multiplicative model ($R^2 = 0.02$, $F = 5.03$, $p < 0.05$; exploration × exploitation: $\beta = 0.14$, $p < 0.05$); while the subtractive model (|exploration − exploitation|) ($p > 0.10$) and the ratio model (exploration/exploitation) ($p > 0.10$) showed a significant loss of the ambidexterity effect. The results from Edwards (1994) test show the additive index is likely to be superior as it loses the least information.

Based on the results of Edwards (1994) test and following prior research (e.g. Blindenbach-Driessen & van den Ende, 2014; Halevi et al., 2015; Hughes et al., 2010; Jansen et al., 2009; Lubatkin et al., 2006), we employed the additive item of explorative and exploitative capability to measure innovation ambidexterity ($\alpha = 0.84$). This operationalization is consistent with the theoretical promise of ambidexterity that the higher levels of magnitudes of exploration and exploitation increase the likelihood of developing a higher

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level of ambidexterity; in turn, it enhances firm performance (e.g., Kammerlander, Bruger, Fust, & Fueglistaller, 2015; Lubatkin et al., 2006).

EO is conceptualized as a strategic posture that reflects a firm's propensity of innovativeness, proactiveness and risk-taking (Covin & Slevin, 1989, 1991). The measure of EO is therefore based on Covin and Slevin's (1989) widely accepted nine-item scale that measures EO as "a basic, unidimensional strategic orientation" which is a first-order reflective construct (Covin & Slevin, 1989, p79). Prior research also argues while innovativeness, proactiveness and risk-taking could represent variance independently (Lumpkin & Dess, 1996), "It appears premature to suggest a multidimensional rather than unidimensional conceptualization of EO" as the effects of innovativeness, proactiveness and risk-taking on performance "seem to be relatively similar in magnitude" (Rauch et al., 2009, p776).

Moreover, one of the key purposes of our research is to investigate the effect of the interaction of overall EO with capability-based HRM and the use of first-order unidimensional operationalization is consistent with previous studies on the interaction of EO and HRM (e.g. Messersmith & Wales, 2013; Tang et al., 2015). To further acknowledge the issue of EO dimensionality (Lumpkin & Dess, 2001; Rauch et al., 2009; Stam & Elfring, 2008), following previous studies (Stam & Elfring, 2008; Van Doorn, Jansen, Van den Bosch, & Volberda, 2013), we conducted factor analysis and found all items loaded on a single factor with an eigenvalue of 3.647. We also found that three out of nine items were with factor loadings lower than 0.50. We eliminated these three items from the traditional EO scale to purify the measure. Prior research has shown the validity rationality of removing and modifying items from Covin and Slevin's (1989) original EO scale (Dai, Maksimov, Gilbert, & Fernhaber, 2014).

Thus, given the purpose of our research, based on the results of factor purification and following prior research (e.g. Brouthers, Nakos, & Dimitratos, 2015; Covin & Slevin, 1989; Engelen, Kube, Schmidt, & Flatten, 2014; Rauch et al., 2009; Stam & Elfring, 2008; Van Doorn et al., 2013), we integrated six items, capturing innovativeness, proactiveness and risk-taking, into a unidimensional index of EO. Each item was measured on a seven-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree ($\alpha = 0.87$).

We measured *capability-based HRM* with four items adapted and modified from prior research (Lopez-Cabrales et al., 2009; Mäkelä et al., 2012; Prieto & Santana, 2012). The scale captures the extent to which selection, training, participation and management form capability-based human capital which is closely related to innovation and creativity ($\alpha = 0.86$). The items were measured on a seven-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree.

We employed three control variables: *firm size*, *firm age* and *business types*. Firm size was measured by the logarithm of the number of employees. We also used the logarithm of the number of years that the firm has operated to measure firm age. Number of business types was presented by categorical measures (1 = one type, 2 = two types, 3 = three types, 4 = four types, 5 = five or more types).

3.3. Reliability and validity

Prior to hypothesis testing, we took several steps to ensure reliability and validity. First, *reliability* of the constructs was evaluated with Cronbach's alphas and composite reliabilities (CRs). As shown in Table 2, Cronbach's alphas ranging from 0.86 to 0.92 are above the recommended level of 0.70 (Nunnally, 1978) and the values of CRs ranging from 0.87 to 0.92 are also satisfactory (Fornell & Larcker, 1981). These results suggest that the reliability of the main constructs is acceptable.

Second, we assessed *convergent validity* through confirmatory factor analysis (CFA). The CFA of a five-construct model demonstrates that the measurement model fits the data well ($\chi^2/df = 2.985$, $p < 0.001$, comparative fit index [CFI] = 0.921, Tucker–Lewis index [TLI] = 0.905 and root mean square error of approximation [RMSEA] = 0.078). All items loaded significantly on the corresponding latent construct with acceptable values of standardized factor loading ranging from 0.59 to 0.90. Moreover, the results of the average variance extracted (AVE) estimates ranging from 0.53 to 0.65 were above the 0.50 cut-off. These results confirm satisfactory convergent validity (Fornell & Larcker, 1981; Gerbing & Anderson, 1988).

Third, discriminant validity was established using Fornell and Larcker's (1981) test. As shown in Table 3, the square roots of the AVE values are greater than all corresponding correlations. Further, all correlations in Table 3 are smaller than their respective reliability (0.86–0.92). These results provide evidence for discriminant validity.

Finally, we employed two approaches to check for common method bias. First, we performed Harman's single-factor test. The results show that there are five factors with eigenvalues greater than 1.0. Together, they explained 69.8% of variance. However, no single factor was

Table 2
Measurement items and validity assessment.

Construct and items	Factor loading
Firm performance (Cronbach's $\alpha = 0.90$, CR = 0.90, AVE = 0.56)	
…overall efficiency of operations	0.83
…market share growth	0.82
…return on investments	0.79
…return on sales	0.79
…profit growth	0.69
…return on assets	0.67
…sales growth	0.59
Explorative capability (Cronbach's $\alpha = 0.88$, CR = 0.89, AVE = 0.62). Compared with major competitors, to what extent over the past three years has your firm had stronger ability to …	
…acquire entirely new manufacturing technologies and skills	0.87
…strengthen innovation and business skills in areas where your firm had no prior experience	0.87
…acquire entirely new managerial and organizational knowledge and skills that are important for innovation	0.82
…learn knowledge for product and process development that are entirely new to the firm	0.75
…acquire new and advanced knowledge and skills for business	0.61
Exploitative capability (Cronbach's $\alpha = 0.92$, CR = 0.92, AVE = 0.65). Compared with major competitors, to what extent over the past three years has your firm had stronger ability to …	
…upgrade skills in operational processes in which your firm already had significant experience	0.87
…enhance knowledge and skills in exploiting resources and technologies	0.86
…upgrade current knowledge and skills for products and processes your firm was already familiar with	0.82
…improve quality of the firm's products and processes	0.79
…improve efficiency of innovation activities by speeding up innovation product and process development	0.77
…improve attributes of the firm's products and processes	0.72
Entrepreneurial orientation (Cronbach's $\alpha = 0.87$, CR = 0.87, AVE = 0.53)	
Our firm favors a strong emphasis on tried and tested practices, equipment and processes	0.78
In general, the top managers of our firm tend to invest in high-risk and high-return products and projects	0.75
Our firm seeks to explore knowledge and information of products characterized by a tendency of experimental and risk-taking	0.75
Our firm places a strong emphasis on products and services innovation activities	0.71
Our firm tends to response to market and industrial changes ahead of competitors	0.69
Our firm tends to initiate actions in the market and industry to take opportunities	0.69
Capability-based HRM (Cronbach's $\alpha = 0.86$; CR = 0.87, AVE = 0.62)	
The top managers of our firm hire and evaluate employees based on their ability, skill and performance fit with the organization	0.90
Our firm encourages employees to actively engage in important decisions and make suggestions in a wide range of issues.	0.86
Our firm provides specialized training to enable employees to enhance learning and have greater insight into their jobs	0.76
Our firm provides flexible strategies and organizational environment to enable employees to develop critical thinking and specific ability and skill	0.59

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Table 3
Descriptive statistics and correlations.

	Mean	s.d.	1	2	3	3	4
1. Firm performance	4.06	1.62	**0.75**				
2. Explorative capability	4.66	1.06	.32***	**0.79**			
3. Exploitative capability	4.65	1.06	.35***	.68***	**0.81**		
4. Entrepreneurial orientation	4.18	1.16	.40***	.37***	.27***	**0.73**	
5. Capability-based HRM	4.29	1.28	.25***	.46***	.41***	.34***	**0.79**

Note: Bold diagonal entries are square root of AVEs.
Significance levels: †p < 0.10; *p < 0.05; **p < 0.01; ***p < 0.001.

dominant and the first factor accounted for 27.9% out of the 69.8% explained variance. The results of a single-factor CFA model also showed a much poorer fit with data (χ^2/df = 8.066, CFI = 0.51, TLI = 0.43 and RMSEA = 0.16) than that of the designed five-construct model. We further used the marker-variable method (e.g., Lindell & Whitney, 2001; Maholtra, Kim, & Patil, 2006; Podsakoff, Mackenzie, Podsakoff, & Lee, 2003). We selected the identification code of the company as a marker variable. The results show that the identification code was insignificantly related to any of the five key constructs, and the discriminant validity test, consistent with common method bias (Merrilees, Rundle-Thiele, & Lye, 2011), also shows satisfactory results. Collectively, these results suggest no evidence of common methods bias in this study.

4. Analysis and results

We tested our hypotheses in several ways. First, we performed regression analyses to test the direct effects of the interaction of EO and capability-based HRM on innovation ambidexterity. Second, in line with prior research, which suggests a combined approach to the test of mediation (e.g. Lin & McDonough, 2014; Lin et al., 2013; Preacher & Hayes, 2008), we combined Baron and Kenny's (1986) four-step criteria, bootstrapping technique (Mackinnon & Dwyer, 1993; Zhao, Lynch, & Chen, 2010) and Sobel's (1982) test to test for the mediating effect of innovation ambidexterity on the relationship of the interaction of EO capability-based HRM with firm performance. Baron and Kenny's (1986) four-step criteria helps informally judge if the proposed mediation occurs. It requires (1) the significant effect of the independent variable on the dependent variable, (2) the significant relationship of the independent variable with the mediator, (3) the significant effect of the mediator on the dependent variable, and (4) the significant relationship between the mediator and the dependent variable with the independent variable controlled. The bootstrapping technique together with the Sobel (1982) test was used to formally test the mediating effect.

Prior to testing our hypotheses, the measures of all explanatory and control variables were mean-centered. We also calculated the variance inflation factors (VIFs) for all regression models to assess the possibility of multicollinearity. All VIF values in our model were below 2, indicating no concerns of multicollinearity problems.

Table 4 presents the results of regression analysis. We employed two groups of regression models. The first group has Model 1 and 2 with innovation ambidexterity as a dependent variable, while the second group has models from 3 to 6 with firm performance as a dependent variable. Model 1 and Model 3 are base-line models that contain only the control variables: firm age, firm size and the number of business types.

Model 2 added explanatory variables to test whether the interaction of EO and capability-based HRM is associated with innovation ambidexterity. The results show that the interactive term of EO × CB-HRM is significantly and positively related to innovation ambidexterity ($\beta = 0.14$, $p < 0.05$) in Model 2 ($R^2 = 0.35$, $R^2_{adj} = 0.33$, $F = 20.05$, $p < 0.001$). Thus, Hypothesis 1 is supported. These results also satisfy the second condition of Baron and Kenny's (1986) approach for mediation.

Models 4, 5 and 6 represent the first, third and fourth conditions of Baron and Kenny's (1986) mediation. The results in Model 4 ($R^2 = 0.25$, $R^2_{adj} = 0.23$, $F = 10.03$, $p < 0.001$) show that the term of EO × CB-HRM is significantly and positively associated with firm performance ($\beta = 0.12$, $p < 0.05$). Similarly, innovation ambidexterity is found to be positively and significantly associated with firm performance ($\beta = 0.37$, $p < 0.001$) in Model 5 ($R^2 = 0.21$, $R^2_{adj} = 0.20$, $F = 17.93$, $p < 0.001$). The results in Model 6 ($R^2 = 0.50$, $R^2_{adj} = 0.48$, $F = 27.01$, $p < 0.001$) further show that the significant impact of the interaction of EO and capability-based HRM on firm performance vanishes ($p > 0.10$) when innovation ambidexterity is included in the regression of firm performance and it has a significant and positive effect on firm performance ($\beta = 0.45$, $p < 0.001$). These results together suggest that the mediating effect of innovation ambidexterity is likely to be occurring.

The bootstrapping technique with the Sobel test was used to formally test Hypothesis 2 which predicts the mediating effect of innovation ambidexterity on the relationship of the interaction of EO and capability-based HRM with firm performance. The results, as illustrated in Fig. 2, show that the effect of the interaction between EO and capability-based HRM on innovation ambidexterity is significant ($\beta = 0.34$, $p < 0.001$), as is the significant effect of innovation ambidexterity on firm performance ($\beta = 0.64$, $p < 0.001$). The standardized indirect effect is 0.22. The results in Table 5 further show that the bootstrapped unstandardized indirect effect is 0.28 and for the 95% confidence interval (CI), the lower limit (LL) is 0.123 while the upper limit (UL) is 0.318. The Sobel test also confirms the significance of the indirect effect ($Z = 4.649$, $p < 0.001$). It accordingly confirms that the interaction between EO and capability-based HRM affects firm performance through innovation ambidexterity. Thus, Hypothesis 2 is supported.

We conducted a robustness test by performing another set of regression analysis using the multiplicative index of innovation ambidexterity (exploration × exploitation) as a dependent variable. The results show

Table 4
Results of regression analysis.

	Innovation ambidexterity		Firm performance			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Firm age	−.07 (.16)	−.06 (.13)	−.05 (.12)	−.03 (.11)	−.06 (.07)	−.01 (.09)
Firm size	.15† (.16)	.21** (.14)	.23** (.13)	.26** (.12)	.21** (.07)	.11† (.10)
Business types	.12† (.14)	.15* (.12)	.22** (.11)	.19** (.10)	.12† (.11)	.14* (.08)
Entrepreneurial orientation (EO)		.13* (.12)		.16* (.10)		.06 (.08)
Capability-based HRM (CB-HRM)		.47*** (.12)		.22** (.10)		.10 (.09)
EO × CB-HRM		.14* (.10)		.12* (.09)		.04 (.09)
Innovation ambidexterity (IA)					.37*** (.06)	.45*** (.09)
R^2	0.04	0.35	0.12	0.25	0.21	0.50
Adjusted R^2	0.03	0.33	0.11	0.23	0.20	0.48
F value	3.11	20.05	9.17	10.03	17.93	27.01
Max VIFs	1.53	1.55	1.43	1.46	1.55	1.64

Standard errors are shown in parentheses.
Significance levels: †p < 0.10; *p < 0.05; **p < 0.01; ***p < 0.001.

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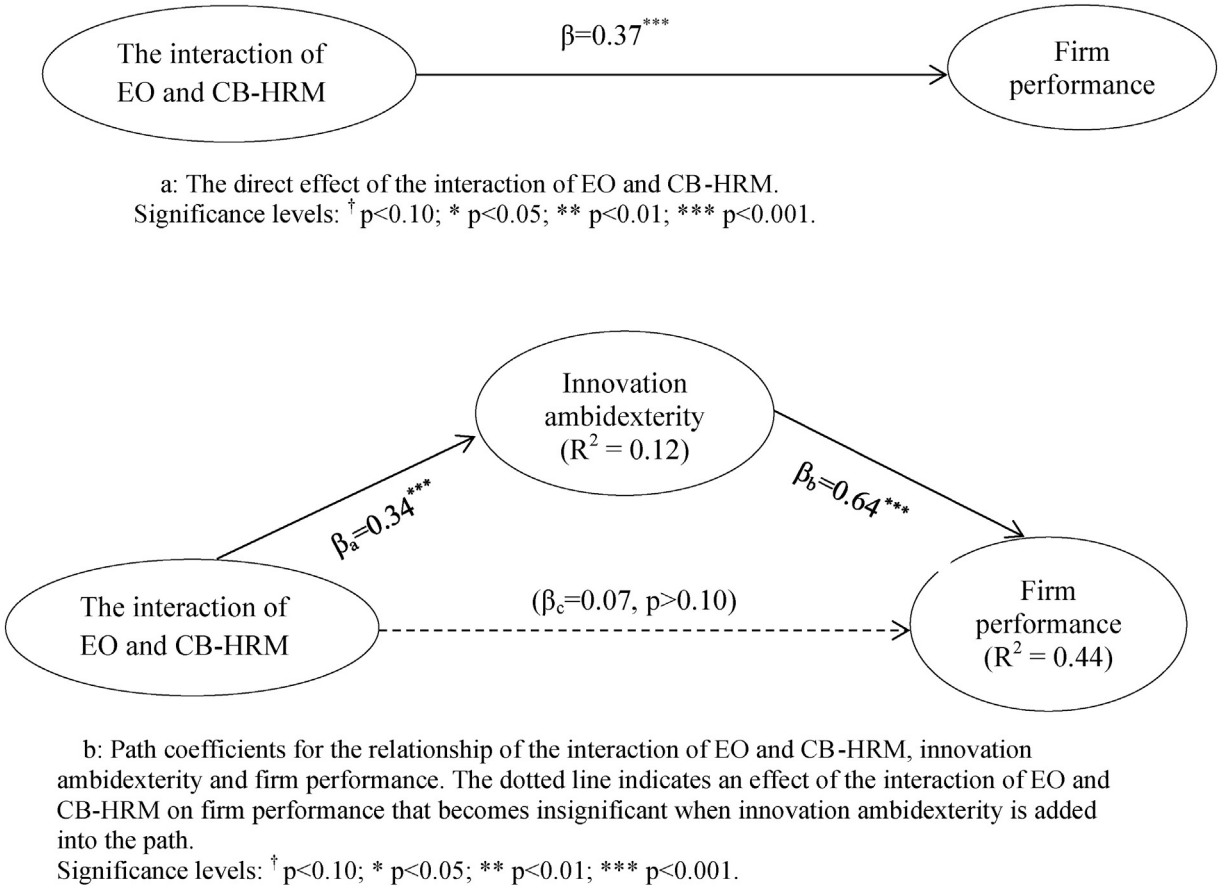

Fig. 2. Results of direct and indirect effects for mediation.

that first, the effects of the interaction of EO and capability-based HRM on both the multiplicative index of innovation ambidexterity ($\beta = 0.14$, $p < 0.10$) and firm performance ($\beta = 0.16$, $p < 0.05$) are significant. Second, explorative capability ($\beta = 0.25$, $p < 0.01$), exploitative capability ($\beta = 0.19$, $p < 0.05$) and their multiplicative item (innovation ambidexterity) ($\beta = 0.18$, $p < 0.05$) are also significantly associated with firm performance. Third, when the multiplicative index of innovation ambidexterity is introduced simultaneously with the interaction of EO and capability-based HRM to the firm performance model, the effect of the EO and capability-based HRM interaction becomes insignificant ($\beta = 0.06$, $p > 0.10$), while the effect of the multiplicative index on performance is significant ($\beta = 0.19$, $p < 0.05$) (for explorative capability: $\beta = 0.24$, $p < 0.01$; for exploitative capability: $\beta = 0.18$, $p < 0.05$). Therefore, these results did not change previous findings for hypotheses testing.

5. Discussion and conclusions

While the ambidexterity literature has shown that firms need to pursue exploration and exploitation simultaneously to achieve superior performance (He & Wong, 2004; Lubatkin et al., 2006; March, 1991), questions have remained about exactly how firms (1) initiate exploration and exploitation and manage paradoxical tensions between the two types of activities, and (2) achieve superior performance from balancing exploration and exploitation. Recent literature has increasingly recognized that EO (e.g. Kollmann & Stöckmann, 2012; Lisboa et al., 2011) and HRM (e.g. Kang et al., 2012; Kostopoulos et al., 2015) can each facilitate ambidexterity, which can in turn result in superior performance. However, we continue to lack a thorough understanding about how these crucial organizational attributes might *interact* to affect ambidexterity, and whether ambidexterity is a *mechanism* through which EO and HRM together result in improvements in firm performance. It is these issues that are examined in this study. Specifically, we examined whether the interaction of EO and capability-based HRM facilitates innovation ambidexterity. In addition we have provided empirical validation for the mediating effect of innovation ambidexterity, as a form of dynamic capability, on the relationship of the interaction of EO and capability-based HRM with firm performance. In the sections that follow we explain the theoretical and managerial implications of our results in more detail.

Table 5
Results of Sobel and bootstrapping tests for mediating effect.

	Unstandardized value	LL 95% CI	UL 95% CI	Z
Indirect effect	0.28	0.123	0.318	4.649***

Significance levels: †p < 0.10; *p < 0.05; **p < 0.01; ***p < 0.001.

5.1. Theoretical implications

The theoretical implications of our findings are twofold. First, previous research focuses on singular types of antecedents to ambidexterity, such as EO and HRM. In advancing this literature, we posit that EO and HRM interactively affect innovation ambidexterity. The results related to the significant effect of the interaction between EO and capability-based HRM indicate that even though EO may help firms to employ resources that facilitate the development of opportunity-seeking (radical) and advantage-seeking (incremental) innovation (Kollmann & Stöckmann, 2012; Lisboa et al., 2011), firms need to simultaneously establish organizational systems and structures that will support this orientation. In other words, if EO is to benefit the development of innovation capabilities, firms need to find a way to appropriately direct their

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resources towards firm innovativeness, proactiveness and risk-taking. These findings provide new insights into the integrated effects of organizational practices on the pursuit of ambidexterity (He & Wong, 2004).

Our findings further develop this literature which has highlighted the importance of developing a supportive structure to align and fit workforce capabilities and intellectual capital with organizational requirements (e.g., Armstrong, 2011). Specifically, our findings suggest that the extent to which entrepreneurial-oriented firms, seeking to develop ambidexterity in innovation, are likely to realize performance benefits may depend on their selection and development of appropriate capability-based HRM. Likewise, firms directing HRM towards explorative and exploitative innovation may be more successful by enacting EO as it "permeates an entire organization's outlook and operations" (Covin & Miles, 1999: 48). Accordingly, our research enriches the literature which calls for research on combining EO and HRM (e.g., Kang & Snell, 2009) by demonstrating the importance of the interaction between EO and capability-based HRM in generating ambidextrous innovation.

Second, our research contributes to the ambidexterity literature by providing new insights into the mediating effects of innovation ambidexterity on the interaction between EO and capability-based HRM with firm performance. Generally, while prior literature has focused on the identification of antecedents of ambidexterity (e.g., Gibson & Birkinshaw, 2004; Jansen et al., 2009) and called for research on outcomes of ambidexterity (e.g., Voss & Voss, 2013), our research shows that innovation ambidexterity is not only a balance of exploration and exploitation but also a mechanism of dynamic capability through which organizational resources developed in localized practices (e.g., entrepreneurial orientations and HRM) can be integrated to elicit innovation capabilities that enable firms to generate superior performance (Atuahene-Gima, 2005; O'Reilly & Tushman, 2008). Specifically, as discussed previously, while a body of research has established the EO-performance and HRM-performance relationships respectively, both the EO (Phan, Wright, Ucbasaran, & Tan, 2009) and the HRM (Messersmith, Patel, Lepak, & Gould-Williams, 2011) research has a "black box" which calls for further understanding of the mechanisms underlying these relationships. In an attempt to open up this "black box", our findings suggest that innovation ambidexterity enables a path dependent process in which firms shape their organizational operations (i.e., operationalizing EO) so that they are aligned with supportive structures (i.e., HRM practices). This arrangement allows the firm to configure, renew and leverage their organization's resources in a unique and inimitable way and, in turn, enhance their firm performance. In other words, although the interaction between EO and HRM provides the impetus for generating synergic resources which may deliver superior performance, firms cannot expect an immediate and direct benefit from such interaction. Instead, effective interactions between EO and HRM help firms to manage tensions arising from explorative and exploitative activities over time. This enables firms to transform resources and subsequently generate an appropriate combination of exploration and exploitation, which in turn, can facilitate superior performance. Our findings therefore also respond to calls in the ambidexterity literature (Hill & Birkinshaw, 2014) for research on the organizational mechanisms/processes through which resources arising from different organization attributes are combined and transformed to ambidextrous benefits.

5.2. Managerial implications

From a practical perspective, our research has important implications for managers. First, our results suggest that firms pursuing explorative and exploitative innovation should be aware of the interaction between EO and HRM. Traditionally, innovation has emphasized the importance of EO. Our findings are a reminder to managers that EO alone is not enough to facilitate effective innovation and that they need to develop an appropriate HRM system that can be incorporated with entrepreneurial orientations if the impetus for both explorative and exploitative innovation activities is to be created. For example, firms may develop a supportive system from capability-based HRM which might see explorative behaviors such as creativity and risk-taking encouraged through autonomous work practices and teamwork. Exploitative behaviors, on the other hand, which are focused on continuous improvement, are likely to be realized through initiatives that help employees understand the work operation in its entirety, such as job rotation and job enlargement. All these practices should be internally consistent with each other (Huselid, Jackson, & Schuler, 1997) and, additionally, they should not only enhance employees' capabilities (Boxall & Purcell, 2003), but they should also help align employees' attitudes with the firm's entrepreneurial orientation, and in turn cultivate both explorative and exploitative innovation activities.

Second, our results indicate that innovation ambidexterity is an appropriate mechanism through which firms integrate the benefits of EO and HRM that enhance superior firm performance. Although not specifically hypothesized in our study, the direct and significant effect of innovation ambidexterity on firm performance shown in our paper suggests that managers should be aware that innovation ambidexterity itself is a significant contributor to firm performance. Consequently, to enhance performance and to avoid the explorative versus exploitative trap, managers need to develop innovation strategies which are dual-focused. Additionally, to optimize the benefits of innovation ambidexterity, both its antecedents and its outcomes should be considered in parallel and in a systematic way. When managers are allocating resources to explorative and exploitative activities they should be cognisant of the need to align HRM with the strategic orientation being prioritized to develop value-creating dynamic capabilities (i.e., innovation ambidexterity) over time. Only then can firm-specific capabilities result in superior performance. This suggestion lends credence to prior work which suggests innovation ambidexterity acts as a dynamic capability for achieving superior performance (Li & Huang, 2012; Lin et al., 2013; O'Cass et al., 2014).

5.3. Limitation and direction for future research

While our research provides insights into the relationships between, EO, capability-based HRM, innovation ambidexterity and firm performance, as with most research, it has several limitations that offer avenues for future research. First, our research highlights the importance of investigating the interaction between EO and capability-based HRM in developing innovation ambidexterity. We examined practices related to capability-based HRM. However, future research could explore different bundles of HRM practices across different functional areas and domains of HRM which might have different interactive effects with EO and its impact on ambidexterity. Similarly, future studies might also validate our findings with distinctions of different EO dimensions of innovativeness, proactiveness and risk-taking. Second, although analyzing the mediating effect of innovation ambidexterity in a combined construct of exploration and exploitation is theoretically and practically meaningful, and the use of a single combined index such as an additive index of ambidexterity is fairly common in the literature, future research would also benefit from developing an effective way to integrate different indices of ambidexterity. Specifically, integrating different indices of ambidexterity may provide new insights into how firms combine exploration and exploitation in various ways and benefit from them (Cao et al., 2009; Patel et al., 2013). Moreover, it is also valuable for future research to examine the mediating effects of exploration and exploitation respectively. Exploration and exploitation could be framed according to different combinations of antecedents and may lead to different performance outcomes. Future research could distinguish between different types of firm performance such as growth (market exploration) and efficiency (market exploitation) to analyze the relationships proposed in the paper. Third, the use of cross-sectional data precludes the testing of a causal relationship between

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resources generated by EO, HRM, innovation ambidexterity and performance. Future research could conduct longitudinal studies on the process of resource combination and the impact of developing innovation ambidexterity in achieving superior performance. Finally, our research builds on perception-based constructs to measure firm performance, innovation ambidexterity, EO and HRM. Although an appropriate analysis to assess the validity of these measurements has been conducted in our research, alternative measures based on more objective data should also be examined.

In conclusion, this research investigates the antecedents and performance outcomes of innovation ambidexterity in parallel by (1) highlighting the importance of the interaction of EO and HRM in developing innovation ambidexterity and (2) demonstrating innovation ambidexterity as an effective mechanism that helps firms translate firm-specific resources, generated from the combination of EO and capability-based HRM into firm superior performance. In making this assessment, our research provides new insights into the complex endeavor of innovation ambidexterity and its performance outcomes. It also represents a further step towards better understanding the mechanism of innovation ambidexterity for both the EO-performance and the HRM-performance relationships.

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