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Dynamic capabilities and innovation ambidexterity: The roles of intellectual capital and innovation orientation

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ABSTRACT

Previous research has highlighted the importance of firms engaging in innovation ambidexterity through balancing exploiting existing offerings with exploring new opportunities. However, not all firms are equally capable of doing so. To improve our understanding of how firms can better achieve such innovation ambidexterity, we develop a framework investigating the joint effects of intellectual capital, dynamic capabilities, and innovation orientation on innovation ambidexterity. We empirically assess this framework using time-lagged, multi-source data from the pharmaceutical industry. The results suggest that intellectual capital positively relates to innovation ambidexterity through dynamic capabilities. We further find that firms with an innovation orientation are more likely to leverage dynamic capabilities to drive innovation ambidexterity. This study contributes to literature on intellectual capital and innovation ambidexterity, and offers managers insights on how to align their knowledge practices to develop dynamic capabilities when pursuing innovation ambidexterity.

1. Introduction

Globalization and changing technologies have created a competitive business environment that drives companies to frequently develop and introduce new products or services (Ardito, Messeni Petruzzelli, Dezi, & Castellano, 2020). In this context, previous research has highlighted the importance of firm competencies to generate innovations that exploit existing products, skills and resources, while simultaneously exploring new opportunities (Chang, Hughes, & Hotho, 2011). We have learned about the positive effects of balancing exploration and exploitation in innovation (Wei and Zhao, 2014); that is, firms that focus solely on exploitation may lack the competencies and knowledge resources to adapt to an evolving environment, while firms that emphasize exploring new and uncertain solutions may fail to develop and refine the existing competencies required to succeed in a competitive market (Ardito, Petruzzelli, & Albino, 2021). Accordingly, firms engaging in so-called innovation ambidexterity need to balance exploiting existing offerings by engaging in incremental innovation with exploring new opportunities (Andriopoulos and Lewis, 2009). Yet, not all firms are equally able to do so as both types of innovation compete for the same organizational resources (Benner & Tushman, 2015; Fourne, Rosenbusch, Heyden, & Jansen, 2019).

We have learned that as innovation oftentimes requires the acquisition and utilization of new knowledge (Castaneda & Cuellar, 2020), knowledge assets in organizations, such as intellectual capital (IC) defined as the stock of knowledge embedded in a firm (Duodu & Rowlinson, 2019), render firms more capable of realizing such innovation ambidexterity. Related, previous research has identified the important role that dynamic capabilities (DCs) – the firm's capacity to sense and seize opportunities and make necessary recourse base adjustments – play in driving ambidexterity (Wilden, Hohberger, Devinney, & Lavie, 2018). However, notwithstanding the fact that IC and DCs are capable of promoting firm innovation separately (Cabrilo & Dahms, 2020; Birkinshaw, Zimmermann, & Raisch, 2016), we lack an understanding of how IC and DCs relate to drive innovation ambidexterity. Therefore, in this study, we develop and empirically test a framework that integrates IC and DCs to better understand their important relationship in driving innovation ambidexterity.

A wide range of theories have been proposed to explain the IC-innovation relationship such as absorptive capacity (Oliveira, Curado,

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Balle, & Kianto, 2020), intrapreneurship (Asiaei, Barani, Bontis, & Arabahmadi, 2020), organizational learning (Cabrilo and Dahms, 2020), operational capabilities (Hassan, Mei, & Johari, 2017), knowledge management (Hsu & Sabherwal, 2011), knowledge sharing (Obeidat, Abdallah, Aqqad, Akhoershiedah, & Maqableh, 2017), technological innovation (Xu, Shang, Yu, & Liu, 2019), and innovation speed (Wang, Cai, Liang, Wang, & Xiang, 2018). The underlying logic behind the DC view is the ability to learn from both inside and outside the firm, to integrate new resources with existing ones (Hsu & Wang, 2010, Han & Li, 2015). Even though previous studies have considered DCs as a potential linking mechanism to explain the IC-innovation relationship, this research area is fragmented and under researched both theoretically and empirically, limiting our understanding of how DCs act as a bridge between IC and innovation ambidexterity (Randhawa, Wilden, & Gudergan, 2021). Improving our understanding of this interaction, however, is important for several reasons. First, doing so will provide insights into how IC enables firms to exploit their existing resource while exploring new opportunities. Second, while some scholars have connected IC or its dimensions with exploration and exploitation (e.g., Kang, Snell, & Swart, 2012), less is known about how firms leverage IC components to enable exploratory and exploitative innovation. Third, insights into this relationship will shed light on the IC-innovation ambidexterity link, generating evidence regarding whether DCs contribute to reconfiguring firms in dynamic markets. Finally, empirical research is needed to test under which internal conditions DCs are more capable of driving innovation ambidexterity. Therefore, in this study, we aim to address the following research question: How can firms improve their innovation ambidexterity by aligning their IC and dynamic capabilities?

We seek to make several contributions with this study. First, we contribute to innovation ambidexterity research by clarifying the relationship between IC and innovation ambidexterity. Most studies conducted to date have adopted IC as a bundle variable that ignores the separate effects of each component independently on desired outcomes (e.g., Han & Li, 2015). To address this gap, we consider IC as comprising three different components: human, structural, and relational capital.

Second, we respond to the call to improve our understanding of how exploration, exploitation, and dynamic capabilities relate (Wilden et al., 2018). Early research interpreted ambidexterity to be a dynamic capability in itself (O'Reilly and Tushman, 2008). However, in their review study, Wilden, Devinney, & Dowling (2016) find that research on ambidexterity and dynamic capabilities has evolved into separate, albeit related, research streams. Therefore, in this study, we complement previous research (e.g., Hsu & Wang, 2010; Han & Li, 2015) by investigating the relationship between dynamic capabilities and innovation ambidexterity, and especially how dynamic capabilities act as a mediator between IC and innovation ambidexterity. Further, this study adopts what Lin et al. (2013) called the realized view of ambidexterity as an organizational-level construct that enables the firm to simultaneously achieve high levels of exploitation and exploration innovation.

Finally, given that Wilden et al. (2016) call for more research examining organizational factors that trigger DCs contributing to superior operational performance, previous research has identified that firms benefit from developing their DCs in both exploitative and explorative ways. Specifically, firms with a market-driving orientation benefit from deploying their dynamic capabilities in a proactive, explorative fashion and those with a market-driven orientation from using them in a reactive and exploitative way (Randhawa et al., 2021). Despite such research highlighting the importance of a firm's strategic orientation in understanding the performance effects of dynamic capabilities (e.g., Wilden & Gudergan, 2017), we found that most prior research has overlooked how IO might affect the relationship between IC and organizational outcomes. This is surprising as IO provides a competitive posture and strategic orientation to firms, making employees feel emotionally and structurally supported to engage in innovative activities (Andonova & Losada-Otálora, 2020). Accordingly, we propose that DCs in firms with a high degree of IO are more likely to drive innovation ambidexterity.

We test our framework using data from the pharmaceutical industry. This industry is especially suitable to answer our research question due to its reliance on IC and knowledge (Hohberger, 2016; Hohberger & Wilden, 2022) as well as the "industry has been subject to increasing regulation and price pressure from governments, while the process of developing drugs has been radically transformed over the last twenty years by the biotechnology revolution" (Birkinshaw et al., 2016, p. 41). The present study is organized as follows. First, the study's theoretical background and the hypothesis development are outlined. Then, the research method is presented. After that, the results are discussed. Research implications, contributions, and recommendations for future research are presented.

2. Theoretical background and hypothesis development

2.1. Intellectual capability, innovation ambidexterity, and DCs

To achieve sustained performance, previous research has stressed that firms need to balance exploratory and exploitative innovations simultaneously, which is referred to as innovation ambidexterity (Lin, McDonough, Lin, & Lin, 2013). While exploitation focuses on maximizing efficiency and control, exploration focuses on experimentation often creating larger wins or losses (Mazzelli, De Massis, Messeni Petruzzelli, Del Giudice, & Khan, 2020). Exploration involves a shift towards new knowledge trajectories, while exploitation refers to learning gained through refinement, selection, and reuse of existing routines, build upon consolidated knowledge bases (Messeni Petruzzelli, 2019). Although several studies have confirmed the relevance of both explorative and exploitative innovations as well as the importance of balancing them to gain a stable and lasting competitive advantage, their coexistence at the organizational level is difficult to maintain (Messeni Petruzzelli, 2019). This is especially relevant in dynamic industries such as the pharmaceutical sector, which faces increasing societal expectations, high costs, and increasing regulations, ultimately putting "pressure on all pharmaceutical firms to simultaneously speed up and increase the effectiveness of the drug development process" (Narayanan, Colwell, & Douglas, 2009, p. 31).

IC may enable innovation ambidexterity by enhancing the firm's ability to seek and acquire new knowledge and techniques that go far beyond existing experience (Cabrilo & Dahms, 2020). Following resource-based logic, much research has considered IC as a key antecedent of competitive advantage through innovation (Dost, Badir, Ali, & Tariq, 2016). IC has commonly been disaggregated into the key resources of human, structural, and relational capital (Steinhöfel & Ikinen, 2016). Human capital (HC) represents the knowledge, skills, and experiences of a firm's employees; structural capital (SC) represents the arrangements, structures, and culture that facilitate the flow of knowledge through the organization; and relational capital (RC) refers to the groups and networks of people with whom the firm has established relationships (Crupi, Cesaroni, & Minin, 2020).

A key task for organizations is to orchestrate these IC resources, which is achieved through deploying dynamic capabilities (Eisenhardt & Martin, 2000). DCs refer to the firm's capacity to render organizations capable of responding to change, which requires learning, integrating, and reconfiguring capabilities (Teece, Pisano, & Shuen, 1997; Gupta & Gupta, 2019; Liu, Ndubisi, Liu, & Barrane, 2020). Knowledge and learning are key components underlying dynamic capability deployment (Zollo & Winter, 2002). The acquisition and utilization of external knowledge associated with DCs leads to improved organizational performance (Wang, Senaratne, & Rafiq, 2015). Thus, we posit that the development of IC in firms can help extract valuable and novel knowledge from the market, identify market opportunities, acquire necessary knowledge, and reconfigure processes to provide superior performance vis-à-vis competitors.

Some scholars have argued that IC does not directly affect innovation but is translated by dynamic capabilities (Han & Li, 2015). Accordingly, high innovation performance cannot be ensured by IC endowment alone. Rather, innovation occurs through knowledge sharing and recombination, which involves the reuse of prior or existing knowledge and capabilities in a new application context (Duodu & Rowlinson, 2016). In fact, it has been widely discussed that IC does not directly lead to organizational innovation but is first converted to organizational capabilities to give organizations more opportunities to meet market needs effectively (Wilden, Gudergan, Nielsen, & Lings, 2013). With respect to DCs, innovation requires codified knowledge distributed across an organization. The role of IC is central to the DC viewpoint, as much of the DC literature is concerned with changing behavior, as well as with building and reconfiguring internal and external competencies (Teece et al., 1997). As Zollo and Winter (2002) note, a fundamental challenge in building DCs involves changing the resource base (Helfat & Peteraf, 2009), as well as the organizations knowledge base embedded in both human capital and organizational routines and processes (Eisenhardt & Martin, 2000; Zollo & Winter, 2002). Consequently, we argue that the relationship between IC and innovation performance develops through DCs. Previous studies indicated that DCs make organizations more capable of translating knowledge resources into innovation performance. Thus, our baseline hypothesis is as follows:

H1: The effect of IC on innovation ambidexterity is mediated by DCs.

H1a: The effect of IC on explorative innovation is mediated by DCs.

H1b: The effect of IC on exploitative innovation is mediated by DCs.

In the following, we explain in greater detail the effects of the three IC components on dynamic capabilities, and ultimately on innovation ambidexterity.

2.2. Intellectual capital and DCs

HC is defined as the aggregation of employees' knowledge, skills, abilities, education, and personality (Vidotto, Ferenhof, Selig & Bastos, 2017). In fact, employees are the main gatekeepers of importing, generating, and speaking of innovative ideas and thoughts, indicating the profound role human capital plays in achieving innovation performance, either in reconfiguring work processes or launching new products or services (Prieto et al., 2012). For the firm to generate value from its resources, for example, by (re)configuring technologies and patents in the pharmaceutical industry, the firm needs to leverage its HC (Bowman and Swart, 2007).

Knowledgeable and qualified employees enable firms to not only detect the need for change but also to coordinate new processes resulting from change (Elsharnouby & Elbanna, 2021; Huynh, Wilden, & Gudergan, 2022). Accordingly, prior research has suggested that HC positively affect the firm's learning capability, as it enables employees to discover and apply knowledge and expertise in organizations to develop creative ideas (e.g., Tsou & Chen, 2020). Indeed, strong HC enables firms to acquire new knowledge and improve individual skills, which opens the opportunity to develop learning capability, integrate the new knowledge with the existing knowledge, and reconfigure in line with environmental changes (Altintas & Ambrosini, 2019). When a company has strong HC, it can seize opportunities internally by either retraining existing employees or hiring new ones (Chatterji & Patro, 2014). Employees with higher levels of knowledge, skills, and experience can identify potential opportunities and threats, and adapt congruently to environmental conditions. This occurs mainly due to employees' ability to acquire, apply, and transfer required valuable knowledge and effectively integrate, reconfigure, and reallocate resources and capabilities.

In the context of DCs, previous research in the pharmaceutical industry has highlighted the importance of HC for DCs. Specifically, we learned that human capital in the form of senior managers' cognition and managerial resource orchestration ability affect the development of DCs (Narayanan et al., 2009). In a related study in the pharmaceutical industry, Deeds, Decarolis & Coombs (2000) found that new product development is dependent on the functional and educational background of top managers. A recent study in the same industry empirically confirmed that IC provides firms with the capabilities to develop new products (Yousefi, Ahmady & Mehralian, 2022). These findings support previous innovation research that HC is the most important factor in organizational innovativeness (Han & Li, 2015). Some scholars argued that IC promotes dynamic capabilities conducive to firm innovativeness. For example, Tsou & Chen (2020) found that in dynamic environments where organizational performance relies heavily on inimitable and dynamically linked capabilities, organizations rely on intangible assets in the form of HC, tacit knowledge and skills, organizational experience, and memory. Moreover, Duodu & Rowlinson (2019) claimed that individuals' knowledge and experience not only influence their inclination to share and exchange knowledge, leading to knowledge combination for new ideas, but also facilitate their ability to absorb new knowledge and thoughts. Consequently, firms with abundant HC can improve the learning capability (i.e., dynamic capability) by showing more initiative to perceive environmental changes, seize market opportunities faster, and avoid threats in time (Han & Li, 2015), which are the main predictors of innovation ambidexterity.

Highly experienced and educated employees can challenge established organizational routines; therefore, they push the organization beyond technological boundaries and inspire it to acquire more capabilities to reconfigure as the environment evolves (Han & Li, 2015). Moreover, superior HC holds a greater cognitive ability to be alert to opportunities in the current business environment and respond quickly by renewing the resource base which is mostly rendered by employees' knowledge (Tsou & Chen, 2020). This is because the combination, integration, and reconfiguration capabilities reside in the articulation and codification of knowledge embedded in employees. All in all, if employees have higher levels of experience, abilities, and creative insights, they will more likely sense the market, identify the need for changes, and respond to the opportunities raised in the market (Elsharnouby & Elbanna, 2021). Not surprisingly, the higher the level of HC, the more chances organizations have to develop DCs.

H2: Human capital is positively associated with DCs.

A second component of IC is SC, which refers to infrastructure, systems, institutionalized knowledge, routines, manuals, and intellectual property rights (Peñalba-Aguirrezabalaga et al., 2020). In a dynamic environment, SC cannot be the source of innovation ambidexterity per se unless the firm leverages it earlier and more skillfully than its competitors to create capability configurations (Han & Li, 2015). To take advantage of market opportunities or explore novel products or processes in an evolving environment, organizations must focus on figuring out how to discover new solutions, develop new knowledge, and reconfigure current operational capabilities. This is achieved through flexible and nimble SC. In this regard, previous studies such as Duodu & Rowlinson (2019) explained that SC enhances absorptive capacity, particularly within firms with non-hierarchical structures, and improves their ability to identify and exploit new knowledge for innovation. Thus, when innovative ideas spread across business units, the ability to transform this knowledge into innovation outcomes is facilitated.

SC has a positive impact on the formation of DCs as properly documented, institutionalized, and preserved knowledge can help in the development of capabilities. It can also be a basis for leveraging mechanisms that generate new combinations of resources. In this regard, research has found a strong association between high levels of SC and the flow of knowledge among employees (Nhon, Phuong, Trung, & Thong, 2020). They further explained that a high levels of SC expedites the acquisition of new resources and that SC is a prerequisite for developing a positive culture that motivates organizational learning, thus encouraging individuals to produce value and achieve organizational potential.

SC supports information sharing among employees and accelerates the acquisition, internalization, and articulation of knowledge (Mehralian, Rasekh, Akhavan, & Ghatari 2013). SC empowers the firm to reinforce its prevailing knowledge and facilitates knowledge accumulation and utilization, which further impacts the creation of learning capabilities (Nhon et al., 2020). If a firm has a decentralized structure, it takes benefit from boosted communication and increased satisfaction and motivation of employees. In fact, effective SC encourages the free flow of communication, and hence, employees have more contribution in decision-making and are more able to respond to the market changes (Beltramino, García-Perez-de-Lema, & Valdez-Juárez, 2020). In a similar vein, SC enables organizations to be more flexible when needed and more agile in responding to their competitors. When well established, this capital develops the systems and routines, making organizations better able to record and disseminate their experiences (Wang et al., 2018).

In addition, organizations have to deal with a variety of environmental challenges, which influence their performance. Instead of utilizing established ways for problem-solving, they require to look for diverse solutions and knowledge in organizational processes and systems with the aim of broadening their chance for combating external changes (Hsu & Wang, 2010). Accordingly, if firms provide the opportunity to deploy knowledge captured in organizational routines, processes, and systems, employees will show far-higher behavioral enthusiasm to drive forward their organizations in the turbulent market (Turner, Maylor, & Swart, 2015). Moreover, if firms want to effectively unify and leverage their existing SC, they need to work hard on developing DCs, allowing them to translate the organizational knowledge base that exists in various forms into new routines or processes to offer novel products or services. Hence, it is no wonder that the higher the level of an organization's SC, the stronger the organization's adaptability and flexibility to change routines and continuously reconfigure its resources.

H3: Structural capital is positively related to DCs.

RC is defined as the extent to which firms tie up with external partners. It enables firms to better communicate with external actors, facilitating the exchange of information, knowledge, and resources (Hughes, Morgan, Ireland, & Hughes, 2011). The firm benefits from RC in the form of broader access to high quality, timely information and external knowledge and skills, all of which positively influence innovation performance. Indeed, connectedness is believed to improve the accessibility of knowledge in organizations or units and can facilitate the combination and development of new knowledge that can underlie exploratory innovation. Organizations with adequate connectedness can access and promote new knowledge creation by developing new connections between different knowledge vectors, which is associated with exploratory innovation (Zhou et al., 2020). Furthermore, it has been argued that RC enables knowledge mobilization and provides members with a better understanding of available knowledge (Mura, Radaelli, Spiller, Lettieri, & Longo, 2014). As stated by Subramaniam & Youndt (2005), such capital affects the trust and collaboration that organizational members need to chase exploitative innovation. Additionally, Margaret & Nathaniel (2019) proposed that RC forms the required capabilities enabling companies to effectively access and utilize subsidiary resources, and balance the contradictory demands of explorative and exploitative innovation. Therefore, IC would lead to improved innovation through developing appropriate capabilities.

IC stimulates the transformation of resources between stakeholders and the firm and motivates stakeholders to share knowledge about market changes, the dynamics of technological innovation, and industry development trends with the firm (Li et al., 2019). Since RC provides opportunities for organizations to be informed about what is happening in the environment by establishing reciprocal relationships with key external stakeholders, it would create a significant opportunity for organizations to reconfigure themselves at the right time. This is essentially achieved through circulating information and knowledge created within the organization. Besides, RC serves as a catalyst for connecting to consistent and diverse sources of information about different firms' practices (Altintas & Ambrosini, 2019; Hongyun, Adomako, Appiah-Twum, & Akolgo, 2019).

Studies such as Sun, Li, & Liu (2020) have suggested that RC represents social network resources that help overcome new challenges in response to environmental changes. Based on their study, the stronger the firm's connections with external stakeholders, the more chances it has to reconfigure itself. That means RC facilitates the integration and reconfiguration of the firm's resources and enables organizations to develop a set of capabilities to respond appropriately to environmental challenges. Robust alliances are critical to developing firms' integration and reconfiguration capabilities. Not surprisingly, Nhon et al. (2020) suggested that well-established social networks enhances organizations' opportunity-seizing capabilities through acquiring information relevant to new opportunities, creating new processes, and obtaining new experiences and expertise. Finally, previous research has suggested that the pharmaceutical industry and healthcare more broadly comprise a dynamic network of resources, great complexity of stakeholder requirements, and fast innovation cycles, which require multiple stakeholders to contribute to innovation (Frow, McColl-Kennedy, Payne, & Govind, 2019; Randhawa, West, Skellern, & Josserand, 2021). Therefore, we argue that RC is important to drive DCs, which ultimately affect innovation ambidexterity:

H4: Relational capital is positively related to DCs.

2.3. DCs and innovation ambidexterity

Research on ambidexterity characterizes ambidextrous organizations as either leveraging existing capabilities to enable incremental innovation or exploring new opportunities to foster radical innovation (Soto-Acosta, Popa, & Martinez-Conesa, 2018). In fact, innovation ambidexterity is achieved if there exists an organizational capacity for change (Ardito, Besson, Messeni Petruzzelli, & Gregori, 2018). Hence, when firms seek competitive leadership, they must not only explore new things in a market but also refine and leverage existing knowledge within organizational boundaries (Li, Vanhaverbeke, & Schoenmakers, 2008). To this end, firms need to continuously establish and execute medium to long-term R&D plans through the processes of seizing and transforming (Kodama, 2017). Therefore, a company's ability to change the patterns of previously used processes is required to use novel ways to produce products or provide services (Gumusluoglu & Acur, 2016).

Many studies have found that organizations that lack dynamic capabilities do not achieve good innovation outcomes because they are unable to deal with changes in the environment (Khattab, 2017). Researchers such as Soto-Acosta et al. (2018) explained that the ability of organizations to use exploratory and exploitative innovation depends not only on the development of various internal capabilities such as information technology and knowledge management, but also on the rapid response to external changes that occur through technological changes, variations in customer preferences, or changes in product demand.

In other words, DCs are underpinned by organizational and managerial capabilities to both identify environmental trends and develop business models that address new threats and opportunities. DCs thus define the firm's ability to innovate, adapt to change, and create products or services that are beneficial to customers (Teece, Peteraf, & Leih, 2016). DCs enable organizations to create a competitive advantage by not only identifying the best time to adopt, but also by gaining experience and adopting best practices across the organization. In this context, studies suggested that DCs are no longer limited to ordinary organizational capabilities, rather they also include those capabilities that create breakthroughs in the form of innovation (Pezeshkan, Fainshmidt, Nair, Frazier, & Markowski, 2016). This is because DCs focus mainly on an organization's ability to adapt resources and capabilities to environmental changes by identifying and calibrating opportunities through continuous scanning, filtering, and exploration of technologies and markets (Lütjen et al., 2019). Once an opportunity has been identified, the company coordinates and integrates operational processes to innovate with the aim of better meeting customer needs (Ilmudeen, Bao, Alharbi, & Nawaz, 2020; Liu et al., 2020). Therefore, we argue that the greater a firm's DCs, the greater its ability to innovate.

H5: DCs are positively associated with innovation ambidexterity.

H5a: DCs are positively associated with explorative innovation.

H5b: DCs are positively associated with exploitative innovation.

2.4. Innovation orientation as moderator for DCs and innovation ambidexterity

IO is defined as "a learning philosophy in which firms have common standards and beliefs about learning and knowledge that pervade and guide all functional areas toward innovation" (Siguaw, Simpson, & Enz, 2006, p. 559). Given the above definition, alignment with proactive growth-based strategies and positive innovation norms is a critical element not only for delivering innovation but also for sustaining an innovative organization. All in all, the crucial role of IO as a situational facilitator can be justified by some factors. Organizations in a competitive market need not only exploratory innovation to increase the chances of technological breakthroughs but also exploitative innovation to accumulate knowledge and capabilities (Li, Zhang, & Zhang, 2020). A high degree of IO increases the firm's ability to identify and create opportunities through its behaviors and actions. To take advantage of these opportunities, firms develop new capabilities to transform resources and redesign their processes and structures (Meliá et al., 2010). IO is a learning philosophy that leads to shared attitudes toward learning and also dictates and directs all operational competencies for innovation; the stronger IO a firm has, the more overarching belief it has to facilitate innovation through unifying and guiding processes and practices. Such firms act dynamically in sourcing and leveraging new know-how to innovate, leading to be more competitive in building and deploying certain resources (Li, Li, Yu, & Yuan, 2019).

An IO encourages "collaboration" with other partners, which is rewarding because the information and capabilities needed for innovation often lie outside the organization (Dobrzykowsk, Callaway, & Vonderembse, 2015). IO can help an organization be open enough to generate and disseminate new ideas about processes and products (Teichert & Bouncken, 2008). Therefore, IO leads to proactive and innovative actions that direct and coordinate organizational competencies toward organization-wide innovation and creativity and subsequent organizational performance. Moreover, in organizations with a high degree of IO, DCs is well suited to contribute to IP. Based on these arguments, we propose:

H6: DCs have a greater positive impact on innovation ambidexterity in organizations with higher levels of IO.

H6a: DCs have a greater positive impact on explorative innovation in organizations with higher levels of IO.

H6b: DCs have a greater positive impact on exploitative innovation in organizations with higher levels of IO.

3. Research methodology

3.1. Sampling and data collection

To test our model, we collected data using an online survey of pharmaceutical firms located in Iran. Pharmaceutical firms play a critical role in the global economy by conducting research, developing, and delivering innovative medicines. Previous research has highlighted the suitability of the biotechnology industry for DC-related investigation (Deeds et al., 2000; Narayanan et al., 2009; Anand, Oriani, & Vassolo, 2010) as pharmaceutical companies as knowledge-intensive firms are highly dependent on knowledge-intensive activities (Mehralian, Nazari, & Ghasemzadeh, 2018), and frequent transitions between exploratory and exploitative innovation are required (Gilsing & Nooteboom, 2006). The required data were obtained from companies listed in the Iranian pharmaceutical industry between 2018 and 2019. The Iranian pharmaceutical market increased annually by about 30 percent, reaching approx. US $6 billion in 2020. Local manufacturers maintained a 95 percent market share in volume and about 25 percent share in value. A wide range of publicly available pharmaceutical products and tight competition in this market require firms in this sector to make significant investments into innovation, making the pharmaceutical industry an ideal context for studies on innovation (Shabaninejad et al., 2014).

Prior to fielding the survey, we pretested the instrument intensively by conducting several in-depth interviews with experienced CEOs to verify the content, clarity, and wording of the statements (De Vellis, 2003). To further evaluate content validity, the measurement scales were reviewed by experts for potential problems in wording (including biased, vague, inappropriate, or double-barreled items). We considered a key informant approach to be appropriate as existing archival data does not describe constructs such as capabilities included in our study. After refining the questionnaire, we sampled from the overall population of 200 pharmaceutical firms manufacturing finished products and active pharmaceutical ingredients in Iran. After imposing the sampling criteria that firms needed to have developed at least one new product per year in the last three years, we sent the survey to 170 firms. To mitigate concerns of common method bias we did not rely on a single source to collect the data but rather collected the independent and control variables from CEOs and middle managers, and the dependent variable from R&D managers. To control for cross-sectional bias, the two surveys were conducted at two different times. In the first round (T1), CEOs were asked to contribute information about the company (age and size), IC, and DCs. IO was measured by asking 1000 middle managers to highlight the degree of IO within the company. The second round (T2) was conducted six months after the T1 survey. In this round, R&D managers were asked to provide us with relevant data on innovation ambidexterity of their respective firms. As a result, 154, 181, and 671 completed questionnaires were received from CEOs, R&D heads, and middle managers, respectively. For IO, an average of 4 middle managers from each firm participated. After cleaning and matching the data, 151 applicable questionnaires remained, resulting in a response rate of 88%. Almost 40% had 3–10 years of experience and the size and age of the firms ranged from 60 to 896 employees and 5 to 63 years, respectively.

3.2. Measurement and variables

To investigate the capabilities included in our model, we used existing measurement models that were suitable to our research context. We underwent thorough back-translation of the questionnaire into English to ensure that the Persian translation was of the required quality and that no essential elements of the original questionnaire were omitted in the translation. Respondents were asked to indicate the level of agreement for each of the measurement model statements on a 5-point Likert scale.

To measure *IC*, we followed best practice in previous research using the three dimensions of human, structural, and relational capital (e.g., Mehralian et al., 2013; Youndt & Snell, 2004; Youndt, Subramaniam, & Snell, 2004). In this regard, three items for human capital, four items for relational capital, and four items for structural capital were used. CEOs were asked to indicate the level of IC in their respective organizations.

Based on the available literature (Lin & Wu, 2014), a three-dimensional approach was used to measure *DCs* as a second-order construct that includes learning, integration, and reconfiguration capabilities; each dimension was measured with four items. To measure DCs, CEOs were asked to indicate the extent to which DCs had been developed in their organization.

The *IO* scale comprises four items (Ayuso and Rodríguez, 2011; Meliá et al., 2010; Dobrzykowski, Callaway, & Vonderembse, 2015). Firm-level IO scores were obtained by averaging the IO scores of all middle managers who participated in the study. To aggregate the data to higher level of analysis, ICC1 (0.09) and ICC2 (0.46) were used to represent the variance illustrated by group membership and the reliability of the group mean. In addition, the multiple-item rwg (j) was used to explain individual-level data aggregation, resulting in a mean of 0.77. All statistics showed an acceptable level of validity according to the recommended values (Bliese, 2000).

We followed previous research to measure *innovation ambidexterity* (Soo, Tian, Teo, & Cordery, 2017; Gatignon, Tushman, Smith, & Anderson, 2002). It is considered a second-order two-factorial construct and includes six items for each type of innovation, that is, exploratory and exploitative innovation. Exploitative innovation evaluates a firm's ability to develop products, services, and processes that are competency enhancing. Exploratory innovation measures a firm's ability to develop products, services, and processes that require the acquisition of new knowledge, skills, and competencies. To measure innovation ambidexterity, R&D managers acted as key informants.

We further included several *control variables*, including years in business (operation) and firm size (the number of employees on the payroll). Because prior works show that firm innovation and firm age are related (Coad, Segarra, & Teruel, 2016), years of activity (operation) was used to control for the firm's age. As previous research has reported a negative effect of the firm's size on innovation performance (Juliao-Rossi, Forero-Pineda, Losada-Otalora, & Peña-García, 2019), we also controlled for the firm size as measured by the number of employees in the year of study. Table 1 shows all variables and the corresponding measures.

3.3. Data validation and statistical methods

Confirmatory factor analysis (CFA) was performed using Mplus 8.0 to verify the unidimensionality of the measurement scales and to assess the fit of the model. Table 1 shows the mean, standard deviation, factor loadings, Cronbach's alpha, and average variance extracted (AVE). The Cronbach's alpha was for each construct was above the threshold of 0.70, indicating reliability. In addition, to assess the reliability of each dimension, we calculated the factor selection criterion proposed by Kaiser (1958) (an eigenvalue greater than one and a full factor loading value greater than 0.5). Convergent validity was examined using the factor loadings and the significance of the t-value. When constructs have multiple corresponding items and the loading of each item is significantly associated with the underlying factor (t-values > 1.96 or < -1.96), the AVE and factor loading values must be greater than or equal to 0.50 and 0.60, respectively (Hair, Ringle, & Sarstedt, 2011).

In addition, discriminant validity was assessed across latent variables based on the approach proposed by Fornell & Larcker (1981), and each AVE was compared to the squared correlation between constructs. To analyze the convergent and discriminant validity between all constructs, a four-factor CFA model was examined where the IC, DCs, IO, and innovation ambidexterity were entered. The model provided an acceptable fit to the data: $\chi 2$ (186) = 309, $p < 0.001$; RMSEA = 0.06;

Table 1
Confirmatory factor analyses and scale reliability.

Variable	Measurements	Factor Loading	AVE	Cronbach's alpha	T-values
Human Capital	Employees are constantly learning from each other.	0.83	0.72	0.80	12.80
	Our employees often come up with new ideas.	0.86			
	Our employees have a culture of teamwork to diagnose and solve problems.	0.85			
Relational Capital	The company interacts well with regulatory agencies (such as the Food and Drug Administration).	0.71	0.63	0.75	11.20
	The company interacts well with decision-makers such as physicians.	0.82			
	Much of the company's activities (e.g., market forecasting, R&D, production, marketing, and sales) are conducted through the execution of alliance strategies with other companies.	0.74			
	The company builds long-term relationships with foreign partners (e.g., suppliers and distributors).	0.74			
Structural Capital	There is a positive organizational culture within the company.	0.77	0.61	0.69	14.25
	There are integrated computer networks within the company (intranet).	0.75			
	A significant part of the personal knowledge of the employees in the company is institutionalized in the form of processes, instructions, and databases.	0.75			
	Our company has well-known brands/products.	0.57			
Learning Capability	We are constantly learning within the organization.	0.85	0.76	0.89	14.23
	In our company, the process of knowledge creation and development takes place according to the requirements of the units.	0.87			
	We are constantly setting up training teams.	0.90			
	We have ongoing cross-department training programs.	0.87			
Integrating Capability	Our company focuses on gathering customer information and discovering potential markets.	0.78	0.71	0.86	12.20
	Our company utilizes the specialized services of other organizations in its management decisions.	0.85			
	Our company focuses on technologies related to the pharmaceutical industry to develop new products.	0.86			
	Our company emphasizes recording and disseminating its experiences (business methods).	0.87			
Reconfiguration Capability	Our company focuses on reorganizing jobs and creating new job opportunities.	0.76	0.72	0.87	12.45
	Our company reacts quickly to market changes.	0.90			
	Our company responds to its competitors in a timely manner.	0.89			
	We have effective and efficient communication with partner organizations.	0.84			
IO	Our company is known as an innovative company.	0.72	0.59	0.87	13.45
	Our company promotes new and innovative products.	0.77			
	Our company is a leader in new product development.	0.63			
	Our company is a leader in creating new technologies.	0.79			
Exploratory Innovation	Our company participates in fundamentally new concepts or principles.	0.86	0.76	0.89	14.67
	Our company actively seeks out new skills that it lacks.	0.88			
	Our company feels obligated to develop many new skills.	0.87			
	Our company feels obligated to learn from entirely new or different knowledge bases.	0.81			
	Our company feels obligated to use different methods and procedures.	0.86			
	Our company feels obligated to do a lot of retraining.	0.79			
Exploitative Innovation	Our company feels obligated to adapt to existing technologies.	0.84	0.71	0.79	13.62
	Our company leverages its existing skills.	0.67			
	Our company relies heavily on its wealth of experience.	0.81			
	Our company relies heavily on its existing knowledge base.	0.77			
	Our company facilitates the sharing of organization's experience	0.76			
	Our company need to provide some expertise to imorove the older products and processes	0.74			

CFI = 0.95 (Browne & Cudeck, 1992). The three-factor model includes the combination of IC and DCs as one factor along with IO and innovation ambidexterity. In the two-factor model, IC, DCs, and IO were combined as one factor along with innovation ambidexterity. For the one-factor model, all four constructs were combined. By comparing the four-factor model with the three-factor, two-factor, and one-factor models, we found that the four-factor CFA model had a better fit than the alternative models, resulting in the discriminant validity of the constructs. In summary, as per Tables 1 and 2 the measures exhibited satisfactory internal consistency, and all correlations of the IC dimensions with DCs, and of DCs with innovation ambidexterity were statistically significant in the predicted directions, supporting the nomological validity of our framework.

4. Results

4.1. Main analysis

Multiple regression analyses have been conducted using SPSS 21 to test the mediating effect of DCs and the moderating role of IO. In addition, for post-hoc analysis, we applied PLS-SEM to test for mediation through DCs. The means, standard deviations, and correlation matrices for all variables are presented in Table 2.

To test our hypotheses, a hierarchical regression analysis was first conducted. Table 3 shows the effect of the IC component on DCs. In Model 1, the control variables were entered first. The results reveal the significant effect of years of employment on DCs (β = -0.12), while the relationship between the number of employees and DCs was not significant (β = 0.04). Next, human capital was entered as an independent variable (Model 2), resulting in a positive and significant effect of human capital on DCs (β = 0.26). Then, structural capital was entered (Model 3), showing that there is a positive and significant relationship between structural capital and DCs (β = 0.24); and finally, relational capital was entered (Model 4), showing that it is positively associated with DCs (β = 0.31). Model 5 shows that human, relational, and structural capitals have a positive and significant effect on DCs (0.21, 0.22, 0.24, $p < 0.01$), accordingly, H2, H3, and H4 are supported by the results.

Next, we examined the mediating effect of DCs between the relationship of IC and innovation ambidexterity, which is shown in Table 4. Regarding Model 1 and Model 7, the number of employees had no significant relationship with exploration innovation (β = 0.07) and exploitative innovation (β = 0.11). Moreover, years of operation had a positive and significant effect on explorative innovation (β = 0.14) but no significant relationship with exploitative innovation (β = 0.9). Models 2 and 8 show that IC has a positive and significant relationship with explorative innovation (β = 0.25) and with exploitative innovation (β = 0.23). Next, Models 3 and 4 were used to examine the mediating effect of DCs in the relationship between IC and explorative innovation, and Models 9 and 10 for exploitative innovation. As shown in Models 3 and 9, significant relationships were observed between DCs and explorative innovation (β = 0.23) and exploitative innovation (β = 0.23), which supports H5a and H5b. Finally, the fourth step examined the changes in the effects of IC on explorative and exploitative innovation when the DC variable was added in Models 4 and 10. The results showed that the relationship between IC and explorative innovation (β = 0.21) and exploitative innovation (β = 0.19) was lower but still significant when DC was entered. The PROCESS macro-bootstrapping approach was also conducted to test the moderated and mediated effects (Hayes, 2012). With 2,000-fold resampling, it was found that the indirect effect of IC on explorative innovation (CI = 95%, [0.034, 0.45]) and exploitative innovation (CI = 95%, [0.024, 0.41]) through DCs was significant (without zero), indicating support for H1a and H1b.

Table 3
Regression analysis on the hypothesized associations of IC with DCs.[a]

Variables	M1	M2	M3	M4	M5
Number of employees	0.004	0.002	0.03	0.04	0.03
Years of activity	-0.12*	-0.09*	-0.14**	-0.11**	-0.08*
Human capital		0.26***			0.21***
Structural capital			0.24 ***		0.22***
Relational capital				0.31***	0.24***
R2	0.04	0.34	0.37	0.35	0.41
Adjusted R2	0.03	0.32	0.36	0.34	0.40
ANOVA F	14.51***	22.6***	33.22***	31.76***	39.37***

[a]Constant term considered. Standardized coefficients can be observed.
*p ≤ 0.10, **p ≤ 0.01, ***p ≤ 0.001.

As shown in Models 5 and 11, the effects of IO on explorative and exploitative innovation were analyzed. The results show that IO significantly and positively affects explorative innovation (β = 0.29) and exploitative innovation (β = 0.25). Next, the moderating effects of IO on the relationship between DCs and explorative innovation and exploitative innovation were tested using Models 6 and 12. The interaction term (DCs* IO) was positive and significant for exploratory innovation (β = 0.25) and exploitative innovation (β = 0.23). To interpret the interaction results, we plotted the moderation effect at one standard deviation above and below the mean for DCs and IO (see Figs. 1 and 2). The figures show that the relationship between DCs and innovation ambidexterity is stronger when IO is stronger, which is in good agreement with H6a and H6b.

4.2. Post hoc analysis

To test the mediation effect DCs on the IC-innovation ambidexterity relationship, the bootstrapping technique embedded in Smart-PLS was used. PLS-SEM is a powerful technique, which has become well-known among social scientist since the past decade and it is widely used in prior studies (Sarstedt, Hair, Nitzl, Ringle, & Howard, 2020; Wilden & Gudergan, 2017). Hair et al. (2017) reported three kinds of mediation: (1) Complementary mediation; (2) Competitive mediation; and (3) Indirect-only mediation.

Complementary mediation happens when indirect and direct effects are significant and share the same direction. In contrast, competitive

Table 2
Means, Standard deviation, Correlations, and Square Roots of the Average Variance Extracted.

No.	Variable	Mean	SD	1	2	3	4	5	6	7	8	9
1	Activity years	37.12	16.13	1								
2	Number of employees	363.03	168.15	0.16	1							
3	Human capital	3.13	0.79	0.003	-0.29**	1						
4	Relational capital	3.5	0.64	0.07	0.122	0.51**	1					
5	Structural capital	3.57	0.66	0.053	-0.043	0.56**	0.54**	1				
6	Dynamic capability	3.49	0.73	-0.15	-0.05	0.58**	0.54**	0.59**	1			
7	Innovation orientation	3.40	0.59	-0.044	-0.023	0.61**	0.56**	0.59**	0.61**	1		
8	Exploratory innovation	3.71	0.84	0.05	0.035	0.52**	0.57**	0.52**	0.57**	0.59**	1	
9	Exploitative innovation	3.29	0.71	0.06	0.045	0.49**	0.59**	0.48**	0.54**	0.57**	0.49**	1

**. $P < 0.01$ (2-tailed) was considered as the significance level.
*. $P < 0.05$ (2-tailed) was considered as the significance level.

Table 4
Results of regression analysis predicting innovation ambidexterity.[a]

Variables	Explorative innovation						Exploitative innovation					
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Number of employees	0.07	0.06	0.03	0.04	0.04	0.03	0.11	0.08	0.03	0.04	0.04	0.02
Years of activity	0.14*	-0.15**	-0.12*	-0.11*	-0.09*	-0.14**	0.09	-0.13**	-0.09*	-0.11*	-0.07*	-0.11**
Intellectual capital		0.25***		0.23***		0.21***		0.23***		0.21***		0.19***
Dynamic capability			0.23***	0.21***		0.20***			0.23***	0.19***		0.17***
Innovation orientation					0.29***	0.23***					0.25***	0.21***
DC* Innovation orientation						0.25***						0.23***
R^2	0.14	0.16	0.55	0.16	0.57	0.40	0.17	0.13	0.54	0.14	0.55	0.53
Adjusted R^2	0.15	0.15	0.54	0.15	0.56	0.39	0.16	0.11	0.53	0.13	0.54	0.52
ANOVA F	19.3***	28.48***	62.61***	34.42***	71.16***	94.16***	19.2***	23.28***	58.41***	1.32***	68.26***	102.46***

*p ≤ 0.10, **p ≤ 0.01, ***p ≤ 0.001.
[a] Constant term considered. Standardized coefficients can be observed.

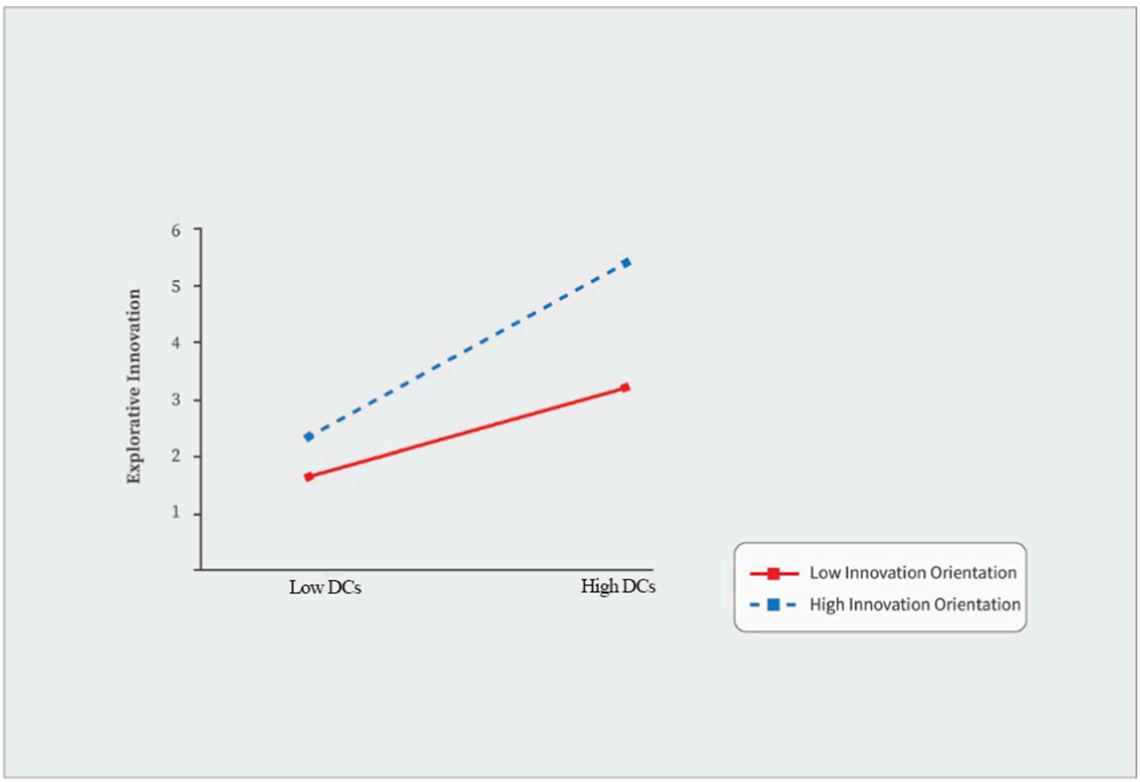

Fig. 1. Moderating effect of innovation orientation on the relationship between DCs and explorative innovation.

mediation occurs when indirect and direct effects are significant but are in the opposite direction. Indirect mediation occurs when the direct effect is not significant, but the indirect effect is. Findings show that the direct effect of IC dimensions on DCs is positive and significant, and there is positive and significant relation between DCs and innovation ambidexterity. In addition, the results presented in Table 5 reveal a positive indirect effect of DCs in IC dimensions-innovation ambidexterity. More specifically, HC shows a stronger effect on both explorative and exploitative innovation, while exploitative innovation and explorative innovation are better explained by SC, and RC, respectively. Accordingly, the mediating effect of DCs in the relationship between IC dimensions and both explorative and exploitative innovation is categorized as complementary mediation. Fig. 3 shows the structural relations among the constructs.

Although we did not hypothesize a moderated mediation relationship, we used the PROCESS macro to test whether the relationship between IC and innovation ambidexterity was moderated by IO through DCs. The results show that the indirect effect of IC on explorative innovation (CI = 95%, [0.06, 0.34]) and exploitative innovation (CI = 95%, [0.07, 0.27]) through DCs was statistically significant at high levels of IO.

5. Discussion and contributions

This study examined how IC acts as a driver of DCs, ultimately leading to innovation ambidexterity. To this end, hypotheses were developed and examined based on data drawn from the pharmaceutical sector. The results of the study confirm a significant direct effect of IC on DCs. By drawing on the DC view and existing research on IC, this study makes important contributions to the mechanisms explaining the relationships between IC and innovation ambidexterity. First, we contribute to innovation ambidexterity research by clarifying the relationship between IC and innovation ambidexterity. Most previous studies have adopted IC as an aggregated variable that ignores the separate effects of each component on desired outcomes (e.g., Han & Li, 2015). To address this gap, we consider IC as incorporating three different components of human, structural, and relational capital. First, we find that HC is a critical factor affecting firms' ability to learn from

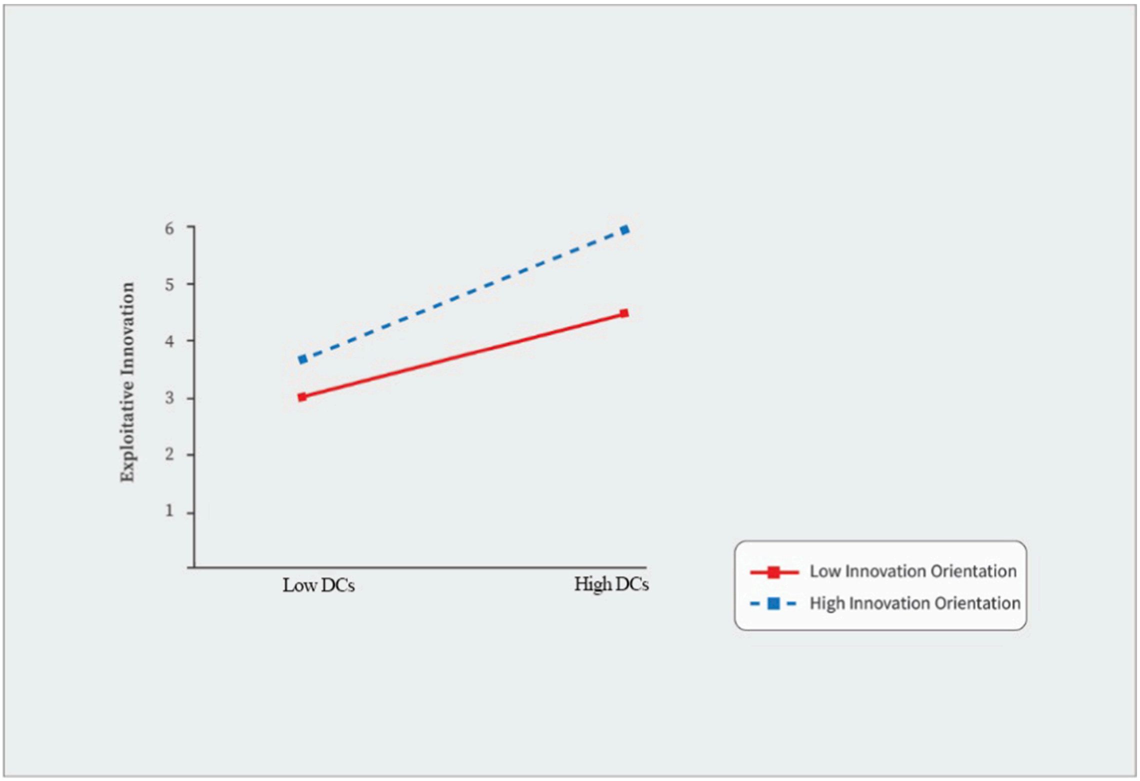

Fig. 2. Moderating effect of innovation orientation on the relationship between DCs and exploitative innovation.

Table 5
Mediation analysis.

Relationship	Direct effect	95% confidence interval of the direct effect	T value	Indirect effect	95% confidence interval of the direct effect	T value
Human capital - > explorative innovation	0.33	(0.271–0.818)	6.8	0.24	(0.236–0.685)	3.9
Human capital - > exploitative innovation	0.29	(0.241–0.635)	5.3	0.19	(0.262–0.517)	3.2
Structural capital - > explorative innovation	0.23	(0.223–0.589)	4.3	0.18	(0.196–0.407)	3.1
Structural capital - > exploitative innovation	0.27	(0.237–0.728)	4.9	0.21	(0.211–0.345)	3.4
Relational capital - > explorative innovation	0.28	(0.253–0.824)	5.1	0.17	(0.177–0.282)	2.7
Relational capital - > exploitative innovation	0.24	(0.251–0.618)	4.6	0.15	(0.092–0.255)	2.3

the market, integrate their resources, and reconfigure themselves. One possible reason could be that skillful and knowledgeable employees support both exploitative and explorative learning. This asset effectively strengthens the acquisition of knowledge from the market and sharing it within the firm. Further, firms with strong HC can more easily take collective action to operate under different conditions and are also stronger in exploratory learning, increasing the potential of identifying market opportunities. Respectively, it is worth mentioning that firms operating in pharmaceutical industry, thanks to their star scientists, are rich in IC as they highly involve in R&D activities, leading to not only generating new drugs, molecules, and patents, but also improving the existing products significantly (Hess & Rothaermel, 2011).

Consistent with previous studies, this study demonstrates that more intense relationships with stakeholders across multiple organizational levels lead to shared value creation, particularly in knowledge-intensive firms (Aribi & Dupouët, 2015). In this situation, IC appears to facilitate innovation ambidexterity by organizing joint product development. For firms operating in the pharmaceutical industry, the ability to encourage and sustain the flow of knowledge among scientists and specialties in various organizational units is crucial for drug discovery. In fact, the discovery cycle of a pharmaceutical product is affected by the loosely articulated networks established among various components. Accordingly, RC can expand the opportunities of combining knowledge and unconnected previously capabilities, reinforcing the notion that RC has a great potential to enhance organizational DCs through the assimilation and application of external knowledge (Veiga et al., 2015). Besides, while previous studies suggested that acquiring knowledge from external sources and assimilating as well as applying knowledge help the firm pursue new market opportunities and improve innovation performance (López-Sáez et al., 2010), our findings provide a more fine grained perspective on how DCs promote innovation ambidexterity. DCs enable the firm not only to integrate internal resources with external resources by linking knowledge and capabilities into the firm's operations, but also to absorb new ideas from external sources with the goal of innovation (Qiu, Jie, Wang, & Zhao, 2019).

Besides, we found out that structural capital enhances the firm's potential to integrate and rearrange existing resources in an agile manner to meet customer needs. Structural capital also aligns new knowledge generated within the innovation process with existing knowledge bases. More specifically, structural capital provides organizations with a capacity to deposit the knowledge in the forms of patents and other transferable forms, allowing all eligible employees to have access to the knowledge they require to change and innovate. This is particularly is very crucial in the pharmaceutical industry as almost all

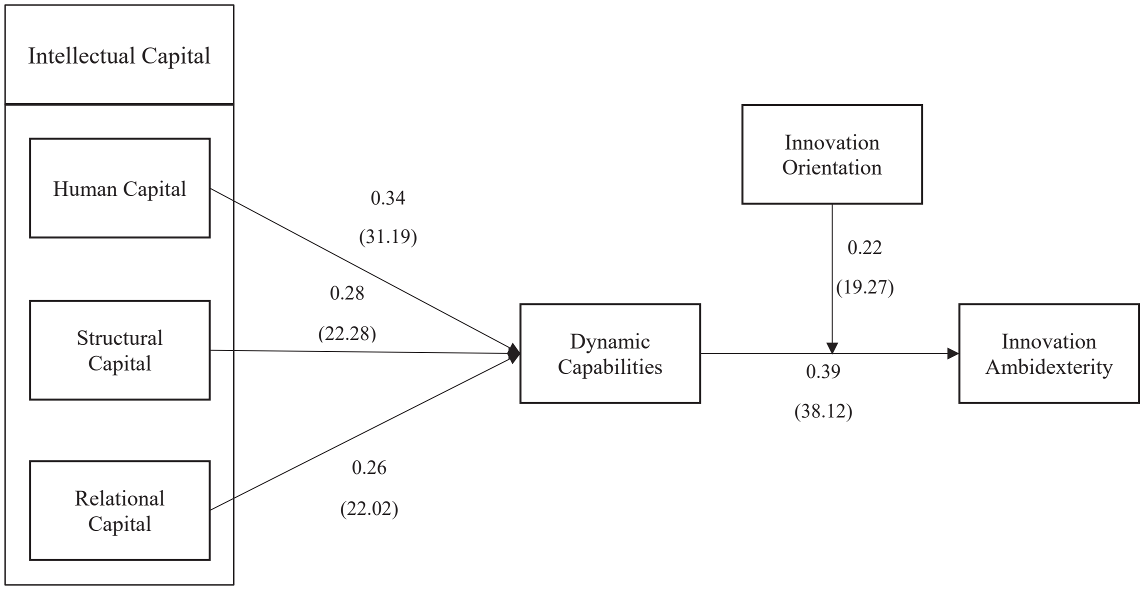

Fig. 3. Structural relations among the constructs.

operations in this sector are highly dependent on codified knowledge. This is mainly true for Iranian pharmaceutical industry due to its tremendous growth since the last decade in terms of developing or acquiring the required knowledge to innovate and supply the medicines and vaccines not only for local consumption but also for exporting goals (Mehralian, Moradi, & Babapour, 2021). Hence, this sector is heavily reliant on the knowledge institutionalized within the companies' systems and routines so that it can be easily circulated within the organization with less time (Festa, Rossi, Kolte, & Marinelli, 2020).

Second, we respond to the call to improve our understanding of how exploration, exploitation, and dynamic capabilities relate (Wilden et al., 2018). Following Wilden et al. (2016), we consider and find support that ambidexterity and dynamic capabilities are separate, albeit related constructs. In this study, we thus complement previous research (e.g., Hsu & Wang, 2010; Han & Li, 2015) by investigating the relationship between dynamic capabilities and innovation ambidexterity, and especially how dynamic capabilities act as a mediator between IC and innovation ambidexterity. Our findings highlight he contributory role of DCs as an important mediator of the relationship between IC and innovation ambidexterity. In fact, the present study supports the views that IC's effect on organizational outcomes can be potentially mediated by other organizational factors (Hsu & Fang, 2009; Hsu & Sabherwal, 2011; Hsu & Wang, 2010). In other words, our findings provide supports to the notion that organizations with high levels of IO will pursue proactive and growth-oriented strategies focused on learning from the outside and will pursue more information-based strategies aimed at creating value for customers. In contrast, organizations with low innovation orientation will pursue strategies that are internally focused, emphasize standardization, and are reactive.

5.1. Managerial implications

Our findings have important implications for managers in general and those working in pharmaceutical companies, in particular. Restated, as innovation ambidexterity is of practical means for responding to frequent regulatory and technological changes (Narayanan et al., 2009), pharmaceutical firms need to develop capabilities that allow them to access and absorb external knowledge, integrate it with existing one, and reconfigure as per external changes (Hohberger and Wilden, 2022) . In this vein, our findings provide insights for pharmaceutical managers to direct their investments beyond only R&D to benefit from their IC, thus fostering DCs to improve innovation ambidexterity. More specifically, the pharmaceutical industry is evolving rapidly as markets change (Min, Desmoulins-Lebeault, & Esposito, 2017). This dynamic industry faces a variety of stakeholders such as patients, regulators, medical professionals, and shareholders, all of whom have specific requirements. Pharmaceutical companies worldwide are at the center of cutting-edge research, development, and delivery of new medicines to society (Leisinger, 2009). Providing people with affordable medicines (e.g., vaccines) has been particularly very crucial for both developed and developing countries over the past two decades. As a result, pharmaceutical companies need to significantly expand their IC to respond to environmental changes in a timely manner. Recent epidemiological upheavals, particularly the COVID 19 pandemic, have increased the pressure on this industry to actively work to promote societal well-being through continued innovation.

The findings point to a significant effect of IC as a key organizational asset that provides firms with more opportunities to learn from the external market, integrate their resources, and reconfigure to innovate. Such intellectual assets force the firm to absorb necessary market knowledge and insights to explore production opportunities. Therefore, it is recommended that managers reinforce IC in the firm to proactively meet customer needs by proposing different products compared to their competitors. This is mainly achieved through the quality of employees that the company hires and retains, organic systems that the company provides, and the knowledge that the company obtains from external stakeholders. Therefore, we recommend that managers should deploy and manage the various components of IC in a way that enhances the identification and exploitation of opportunities through new products that satisfy the changing needs of their customers.

5.2. Limitations and Future research

As with any empirical study, the findings should be interpreted given its limitations. First, our data were drawn from the pharmaceutical industry and from within one country only, which may limit the generalizability of our findings to some degree. However, such an approach improves its internal validity as we can control for exogenous industry factors (Stuart, 2000). Importantly, our findings also provide valuable insights for managers in industries that heavily rely on high degrees of innovation activities and the importance of knowledge assets. Indeed, pharmaceutical firms share similar characteristics as most high-tech firms and other knowledge-based firms (Macher & Boerner, 2012). It is also important to note that the pharmaceutical industry has made significant progress in Iran and has achieved global standards (Ghasemzadeh et al., 2021). In terms of the country context, Iran has experienced exponential growth in knowledge-based firms and start-ups due to increased domestic demand and an increase in technology incubators and accelerators (UNESCO Science Report, 2021). Further, over the last decades, Iran has transitioned to a more market-based economy through liberalization and privatization (Soltani & Wilkinson, 2012), leading to significant environmental turbulence and high uncertainty, requiring dynamic capabilities to be deployed to renew the firm's resource base and achieve innovation ambidexterity (Malik & Korabe, 2009; O'Cass, Heirati, & Ngo, 2014).

Finally, we investigated the impact of IC components and DCs. Further research should consider the relationship between IC as a bundle of human, relational, and structural capital with the components of DCs, including learning, integration, and reconfiguration capabilities. This would provide a fine-grained basis for how IC can promote each component of DCs. Finally, consideration of various exogenous variables, incorporating other measures and organizational factors are recommended. Despite the above limitations, our research is crucial as proactive innovation is likely to continue unabated.

CRediT authorship contribution statement

Mandana Farzaneh: Writing – review & editing, Writing – original draft, Conceptualization. **Ralf Wilden:** Writing – review & editing, Methodology, Conceptualization, Writing – original draft. **Leila Afshari:** Writing – review & editing. **Gholamhossein Mehralian:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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