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The neglected role of knowledge assets interplay in the pursuit of organisational ambidexterity

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Abstract:	Organizational ambidexterity is a strategic challenge for contemporary organizations. It involves the simultaneous or synchronous pursuit of two inherently incompatible and conflicting activities – exploitative learning to become efficient in the current business activities, and explorative learning to predict and work on future challenges, opportunities, and demands. Depending upon the form(s) of ambidexterity an organization adopts, these two conflicting activities can be pursued synchronously in separate units, and/or by employees or asynchronously across different time phases. This study postulated and found that irrespective of the forms of ambidexterity, applying Bontis' (1998) model of interplay between knowledge assets can enable organizations in the successful pursuit of ambidexterity, and asynchronous pursuit of exploration and exploitation. The study used a multisource sample of 424 respondents from firms in various South Korean industries. The findings demonstrated that organisational and social capital are central to pursuing exploration, exploitation, and ambidexterity directly while human capital played a significant role in supporting the other two types of knowledge assets. In addition, social capital played a dual role to be both supportive of organisational capital and central to in the pursuit of ambidexterity outcomes.

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Abstract

Organizational ambidexterity is a strategic challenge for the contemporary organizations. It involves the simultaneous or synchronous pursuit of two inherently incompatible and conflicting activities – *exploitative learning* to become efficient in the current business activities, and *explorative learning* to predict and work on future challenges, opportunities, and demands. Depending upon the form(s) of ambidexterity an organization adopts, these two conflicting activities can be pursued asynchronously across different time phases, or synchronously in separate units, and/or in the same units by the employees. This study postulated and found that the Bontis (1998) model of interplay between knowledge assets can enable the successful pursuit of all the forms of ambidexterity, either synchronous pursuit of exploration and exploitation by the employees across same or different units or asynchronous pursuit across different time phases. The study used a multisource sample of 424 respondents from the various firms in the South Korean industries. The findings demonstrated that the organisational and the social capital are *central* to pursuing exploration, exploitation, and ambidexterity *directly* while human capital played a significant role in *supporting* the other two types of knowledge assets. In addition, social capital played a *dual role* to be both *supportive* of organisational capital and being *central* in the pursuit of ambidexterity outcomes.

Keywords: Knowledge assets; intellectual capital; organizational ambidexterity; organisational learning; organisational learning ambidexterity; exploration; exploitation

1. Introduction

Organisational ambidexterity – the simultaneous and balanced pursuit of explorative learning and innovation, and exploitative learning and innovation - is a strategic challenge for the survival and growth of the contemporary firms (March, 1991). Organisational ambidexterity can be operationalised through innovation (radical vs. incremental) or organisational learning (exploratory vs. exploitative) (He & Wong, 2004; Kang & Snell, 2009; Subramaniam & Youndt, 2005). This study operationalizes organizational ambidexterity through organisational learning. This is because organizational learning ambidexterity concerns a firm's *ex-ante* strategic objectives in pursuing innovation ambidexterity that, in turn, is often understood in an ex-post outcome sense (He & Wong, 2004; Kang & Snell, 2009). 'Organisational learning ambidexterity' refers to an organisation's ability to simultaneously utilise and refine its existing knowledge assets to conduct its daily operations and exploit current opportunities efficiently [exploitation, exploitative learning, or knowledge refinement] while also generating new knowledge to address knowledge gaps and deficiencies and explore future demands and opportunities [exploration, explorative learning, or knowledge renewal] (Birkinshaw & Gibson, 2004; Birkinshaw & Gupta, 2013; Gibson & Birkinshaw, 2004; Kang & Snell, 2009; March, 1991; Swart & Kinnie, 2010; Turner, Maylor, & Swart, 2013). Thus, effective explorative learning and exploitative learning ensure the respective long-term success and short-term success of an organisation.

Given the respective importance of exploration and exploitation for organizational short-term and long-term survival and growth, the simultaneous and balanced pursuit of exploration and exploitation is inherently conflicting and challenging for organizations because these two types of learning require different processes, structures, and orientations. Three forms or ways to pursue organisational ambidexterity have been recommended in the extant subject-matter literature that can be adapted individually or in combinations (Lakshman, Dupouët, & Bouzdine-Chameeva, 2017; Turner, Maylor, et al., 2013). The first is temporal ambidexterity, in which exploitation and exploration dimensions are separated in time (phases) such that the organisations shift from one dimension to other (Tushman & O'Reilly, 1996). The second is structural ambidexterity, in which two activities coexist or are pursued synchronously/simultaneously, but are spatially separated and distributed in separate units, structures, or departments (O'Reilly & Tushman, 2004). The third is

contextual ambidexterity (Birkinshaw & Gibson, 2004; Gibson & Birkinshaw, 2004). Contextual ambidexterity assigns responsibility of pursuing ambidexterity to employees and thus does not require distributing exploration and exploitation across two different structures or time phases (Andriopoulos & Lewis, 2009; Kostopoulos, Bozionelos, & Syrigos, 2015; Raisch & Birkinshaw, 2008). Contextual ambidexterity is operationally defined as the behavioural capacity of employees to simultaneously choose and pursue *alignment [exploitation]* and/or *adaptability [exploration]* [1] as they judge appropriate and beneficial in their daily organisational activities (Birkinshaw & Gibson, 2004; Gibson & Birkinshaw, 2004; Kostopoulos et al., 2015; Raisch & Birkinshaw, 2008; Turner et al., 2014). Here *context* comprises the systems, processes, and beliefs that shape employees behaviours to pursue exploration and exploitation in an organisation (Ghoshal & Bartlett, 1994; Raisch & Birkinshaw, 2008). Contextual ambidexterity assumes that the ambidexterity of an organization as a whole derives from specific actions of individuals so that it is inextricably tied to a firm's efforts to manage human resources. Contextual ambidexterity is considered most effective form of ambidexterity because it does not bear coordination problems and costs as well as it does not require the resource trade-off due to the inherent conflict between two dimensions of ambidexterity, as employees choose to pursue the dimension that is appropriate to the context or the requirements (Birkinshaw & Gibson, 2004; Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008; Raisch, Birkinshaw, Probst, & Tushman, 2009; Turner et al., 2014; Turner, Maylor, et al., 2013).

It is well-established in the extant subject-matter literature that an organization's simultaneous and balanced pursuit of explorative learning and exploitative learning highly depends upon its current knowledge stocks. These knowledge stocks are referred to as *intellectual capital* or *knowledge assets*. The effect of knowledge assets on organizational ambidexterity is considered in line with the contextual form of ambidexterity whereby employees choice between explorative learning and/or exploitative learning as appropriate to the context (Birkinshaw & Gibson, 2004; Gibson & Birkinshaw, 2004; Kang & Snell, 2009; Kang, Snell, & Swart, 2012). Several well-known models of intellectual capital in the extant literature beginning from the seminal model of

[1] Alignment is defined here as organisational activities aimed at common goals (exploitation), whilst 'adaptability' refers to the capacity to reconfigure such activities when pushed/reinforced by the outside task environment (Gibson & Birkinshaw, 2004; Kang & Snell, 2009; Turner, Maylor, et al., 2013).

Bintis (1998) agree that there are three following distinct dimensions or types of intellectual capital or knowledge assets that interact, interplay, align or interconnect with each other to make their joint deployment (Bontis, 1998; Bontis, Chua Chong Keow, & Richardson, 2000; Carrie R. Leana & Buren, 1999; Edvinsson & Malone, 1997; Subramaniam & Youndt, 2005; Youndt, Subramaniam, & Snell, 2004). First dimension or type is the human capital that is conceptualized at the individual level, i.e., the sum of knowledge, skills, and abilities embedded in individual employees. Second dimension is the social capital that is conceptualized at the group level, i.e., the knowledge embedded in the groups and networks including but not limited to the customers' knowledge. Finally, third dimension is the organisational capital that is conceptualized at the firm level, i.e., the knowledge embedded in the organisational systems, structures, methods, and processes.

Our literature review revealed several theoretical and empirical studies at various levels (e.g., operational, individual or managerial, project, and organizational) that proposed, explored, and examined different IC interplays[2], architectures, models, or configurations between knowledge assets to achieve ambidexterity outcome(s) [ambidexterity, exploration, and exploitation] using respective form(s) of ambidexterity [contextual, temporal, and unit or structural forms of ambidexterity]. We have summarized the most relevant, recent, and seminal empirical studies on knowledge assets and ambidexterity outcomes in Table 1. The most prominent intellectual capital architectures or models at the organizational levels for the successful pursuit of ambidexterity outcomes in the empirical subject-matter literature are summarized as follows (Table 1). First, Kang and Snell (2009) proposed *refined interpolation* and *disciplined extrapolation* as two unique intellectual capital architectures to pursue organizational ambidextrous learning in the vein of contextual form of ambidexterity. Disciplined extrapolation is an architecture comprised of generalist human capital, supplemented by entrepreneurial social capital, and complemented by mechanistic organizational capital while refined interpolation is an architecture comprised of specialist human capital, supplemented by cooperative social capital, and complemented by organic organizational capital. Several subject-matter empirical quantitative studies, for example (Diaz-Fernandez, Pasamar-Reyes, & Valle-Cabrera, 2017; Kang et al., 2012;

[2] In line with the extant subject-matter literature on knowledge assets and ambidexterity, we use interplay, architecture, structure, alignment, interaction, or interconnection between knowledge assets interchangeably.

Kengatharan, 2020; Lakshman et al., 2017; Rezende, Torres, Correia, Nicolini, & Bernardes, 2016; Turner & Lee-Kelley, 2013; Turner et al., 2014; Turner, Maylor, & Swart, 2015; Turner, Swart, Maylor, & Antonacopoulou, 2016), drew on Kang and Snell (2009) model to examine and explore different intellectual capital architectures and mechanisms at various levels (e.g., operational, individual or managerial, project, and organizational) to pursue ambidexterity in various organizational, unit, and project contexts by using contextual, temporal, or structural forms of ambidexterity (Table 1).

Second and finally, Subramaniam and Youndt (2005) proposed an intellectual capital architecture that does not categorize each knowledge asset into different types like Kang and Snell (2009), and thus it offers only one architecture. Subramaniam and Youndt (2005) architecture or model of knowledge assets outlines human capital and organizational capital for pursuing explorative innovation and exploitative innovation respectively such that the social capital is a boundary or moderating condition (Table 1). A number of subject-matter empirical studies for example (Duodu & Rowlinson, 2019; Fernández-Pérez de la Lastra, Martín-Alcázar, & Sánchez-Gardey, 2020; Fu, Ma, Bosak, & Flood, 2016; Gürlek, 2020; Kostopoulos et al., 2015; Lin, McDonough, Yang, & Wang, 2017; Mahmood & Mubarik, 2020; Mubarik, Naghavi, & Mahmood, 2019; Subramaniam & Youndt, 2005), drew on Subramaniam and Youndt (2005) architecture and examined different related architectures of and roles of knowledge assets in the pursuit of ambidexterity outcomes (refer to Table 1). Such empirical studies contradict each other in(in)ability of human capital and organizational capital to pursue ambidexterity outcomes (Table 1).

***********please insert Table 1 about here**********

Building onto this literature, the current study argues that the current subject-matter empirical literature has neglected and did not empirically examine the role of Bontis (1998) seminal model of alignment of knowledge assets in the pursuit of organizational ambidexterity outcomes or the form(s) of ambidexterity (see Table 1; Figure 1; Figure 2). Thus, this study argues, that the Bontis (1998) alignment between knowledge assets can enable the pursuit of three forms of ambidexterity. In other words, this study argues that irrespective of the form(s) of ambidexterity organizations choose to pursue, applying Bontis (1998) model of interplay between knowledge

assets can enable them in the successful pursuit of ambidexterity outcomes – organizational ambidexterity or synchronous pursuit of exploration and exploitation in different units or structures [structural ambidexterity] or by employees in the same units [contextual ambidexterity], and asynchronous pursuit of exploration and exploitation in separate time phases [temporal ambidexterity] (refer to Figure 2). Put it simply, the current study postulates and examines Bontis (1998) model of alignment between knowledge assets in the pursuit of all three forms of ambidexterity – structural, temporal, and contextual forms of ambidexterity.

Bontis (1998) model is one of the seminal models of intellectual capitals or knowledge assets amongst other seminal models (e.g., (Edvinsson & Malone, 1997; Subramaniam & Youndt, 2005; Youndt et al., 2004)). It has been presented in the Figure 1. It essentially outlines social capital and organizational capital as the frontline knowledge assets to pursue ambidexterity outcomes while human capital is supportive to them. The detail arguments on the configurations or alignments of knowledge assets in Bontis (1998) model and its potential to advantageously pursue ambidexterity outcomes and forms are provided in Section 2. We indeed acknowledge that the Bontis (1998) alignment between knowledge assets has been examined empirically with a number of value creation outcomes other than ambidexterity, such as innovation and performance (Bontis, 1998; Bontis et al., 2000; Cabrita & Bontis, 2008; Chen, Liu, Chu, & Hsiao, 2014; Kianto, Sáenz, & Aramburu, 2017; Wu, Lin, & Hsu, 2007). However, the empirical literature on knowledge assets and ambidexterity seems to ignore this model (Table 1).

Therefore, the aim of this study was to explore and examine the potential of Bontis (1998) model of interplay between knowledge assets in the successful pursuit of ambidexterity outcomes or the form(s) of ambidexterity. We therefore proposed and tested the model outlined in Figure 2. The data collected comprised 424 middle manager-senior manager dyads in various firms across various South Korean industries. It was analysed using variance-based structural equation modelling via partial least squares.

The remainder of this paper is organised as follows. Section 2 examines the essential nature of Bontis (1998) model of knowledge assets, its relevant advantages, and then proposes the hypotheses. Section 3 summarises the methodology. Section 4 reports the results, and the findings are discussed and concluded in Section 5.

***********please insert Figure 1 about here**********

***********please insert Figure 2 about here**********

2. Theoretical and empirical background

2.1 Bontis (1998) model of alignment of knowledge assets

Bontis (1998) model of knowledge assets argues that the knowledge assets are not effective in isolation and do not exist and operate in neatly separated packages (Figure 1). They are only effective when they are complementary, interrelated, and mutually facilitative to each other such that some knowledge assets [organizational capital and social capital; Figure 1] are primary, interactive, central, or dominant, and directly affect value creation outcomes such as ambidexterity while other knowledge assets are secondary, facilitative, or complementary to the former knowledge assets to support them. Thus, a continuous interplay between the various knowledge assets is required if an organisation is to effectively utilize them to achieve ambidexterity. Bontis (1998) theory or model of interplay between knowledge assets is in line with the alignment theory in the vein of contingency perspective of management theory (Kang et al., 2012; Lin et al., 2017; Subramaniam & Youndt, 2005; Chorn, 1991). Alignment theory states that some assets are primary (i.e., active and thus central in the pursuit of value creation), while others *support* and complement them in the value creation process.

Bontis (1998) empirically explore the alignment between knowledge assets in his exploratory study on the role of intellectual capital in business performance. He explored that the organisational capital and the social capital *directly* affect business performance, and that the human capital *supports* and complements their association with organizational performance (Figure 1). In this alignment, *social capital* plays a *dual* role that it not only affects performance outcomes *directly* but also *supports* organizational capital. Bontis (1998) model begins with the assumption that the human capital (i.e., the sum of knowledge and experience of an organization's employees (Schultz, 1961; Subramaniam & Youndt, 2005) – cannot increase organizational performance by itself until it is leveraged by the relevant groups [social capital] and codified by the mechanisms or organizational processes [organizational capital]. Otherwise, individual

knowledge can become obsolete. Bontis (1998) explains the essence of the proposed alignment as follows (P.71):

"What the two different model specifications are saying is that there must exist a constant interplay among human, structural [organizational] and customer [organizational] capital in order for an organization to leverage off its knowledge base. Isolated stocks of knowledge that reside in the employees' minds that are never codified into organizational knowledge will never positively affect business performance. In other words, it is not enough for an organization to hire and promote the brightest individuals it can find. An organization must also support and nurture bright individuals into sharing their human capital through organizational learning. Unlike normal inventory that can be found in traditional manufacturing settings, individual knowledge stocks that reside in human capital become obsolete. This obsolescence is not necessarily due to outdated knowledge. There is a behavioural explanation instead. Human beings become unmotivated when they feel they are not being utilized or challenged. That is why a stock of human capital will deteriorate if not constantly supported and nurtured."

We find Bontis (1998) model of alignment advantageous in the pursuit of ambidexterity because of the following reasons. First, this model essentially fits well with the spirit of the forms of ambidexterity especially contextual form of ambidexterity. Both the pursuit of any form of ambidexterity and Bontis's (1998) model begin with and stress the seminal and supportive role of humans or human capital in the pursuit of ambidexterity outcomes (Birkinshaw & Gibson, 2004; Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008). Thus, this model is pragmatic as it stresses that those are the humans at different levels who actually perform and pursue ambidexterity outcomes in any form(s) of ambidexterity by using the organizational knowledge assets (Birkinshaw & Gibson, 2004; Fernández-Pérez de la Lastra, García-Carbonell, Martín-Alcázar, & Sánchez-Gardey, 2017a, 2017b; Gibson & Birkinshaw, 2004; Kang & Snell, 2009; Kostopoulos et al., 2015; Raisch & Birkinshaw, 2008; Turner et al., 2014; Turner, Swart, & Maylor, 2013). Second, we argue that the continuous flow of organic and fresh knowledge from human capital and social capital to the organizational capital in Bontis (1998) model can enable and transforms organizational capital to get to a *versatile and flexible form* or *ambidextrous form* (Fernández-Pérez de la Lastra et al., 2020; Lakshman et al., 2017; Turner et al., 2015; Turner et

al., 2016). This form is thus balanced between *mechanistic organizational capital* and *organic organizational capital* (Kang & Snell, 2009) to successfully pursue ambidexterity outcome(s) under any form(s) of ambidexterity. In this vein, Bontis's model can reconcile the contradictory findings of the past quantitative studies at the organizational level on the (in)ability of organizational capital and human capital to pursue exploration and ambidexterity. We refer Table 1 to observe how different empirical studies at the organizational level (e.g., (Diaz-Fernandez et al., 2017; Duodu & Rowlinson, 2019; Fu et al., 2016; Kang et al., 2012; Kengatharan, 2020; Kostopoulos et al., 2015; Lin et al., 2017; Mahmood & Mubarik, 2020; Mubarik et al., 2019; Subramaniam & Youndt, 2005)) contradict each other on the roles of human capital and organizational capital in the pursuit of exploration and thus ambidexterity. We indeed here recognize a range of qualitative empirical studies (e.g., (Fernández-Pérez de la Lastra et al., 2020; Lakshman et al., 2017; Turner et al., 2015; Turner et al., 2016)) that showed how organizational capital can also be conceptualized and exists as *ambidextrous* and thus can be used to pursue exploration.

2.2 Hypotheses development on Bontis (1998) alignments between knowledge assets and ambidexterity outcomes

Human capital, being at the individual level, plays a *supportive and facilitative role* to organisational and social capital, which in turn have dominant and interactive roles in in the pursuit of ambidexterity outcomes (Bontis, 1998). Bontis (1998) suggested that attracting bright and creative employees (human capital) cannot ensure performance outcomes such as ambidexterity, because the knowledge stocks of individuals employees are of no value in isolation until those are exploited by the organizational and group mechanisms. Therefore, organisations must develop and translate the fresh and organic knowledge within the human capital so it can be accessed and exploited in and by the relevant groups (social capital) and processes, manuals, and methods (organisational capital). Otherwise, individual knowledge can become obsolete in organisations (Bontis, 1998). If employees' knowledge is not constantly utilised and challenged, they may lose the motivation to share and learn (Bontis, 1998). Furthermore, one of the primary roles of skilled employees is to serve internal and external stakeholders and gain the knowledge of their feedback and preferences, which should then ultimately be conveyed to the relevant groups and

organisational structures for appropriate and prompted actions (Ashwin W. Joshi & Sharma, 2004; Bontis, 1998; Chen et al., 2014; Tsai & Ghoshal, 1998).

This alignment on the supporting role of human capital is not only supported by the empirical studies on intellectual capital and general innovation and other organizational performance outcomes (Bontis, 1998; Bontis et al., 2000; Cabrita & Bontis, 2008; Chen et al., 2014; Kianto et al., 2017; Wu et al., 2007) but also by the empirical studies on knowledge assets and ambidexterity (see Table 1). Subramaniam and Youndt (2005) and other empirical studies (Duodu & Rowlinson, 2019; Fu et al., 2016; Kang et al., 2012; Lin et al., 2017) contrary to their hypotheses found that human capital standalone affects exploration negatively and/or non-significantly, until it is supported by high amount of social capital (Subramaniam & Youndt, 2005). Furthermore, the findings of other empirical studies (Duodu & Rowlinson, 2019; Fernández-Pérez de la Lastra et al., 2020; Turner et al., 2015) especially the findings of Duodu and Rowlinson (2019) suggest that the social capital and the organizational capital fully mediate between human capital and the pursuit of exploration and exploitation (Duodu & Rowlinson, 2019). It can also be used in combinations with other knowledge assets in pursuing exploratory learning and innovation outcomes (Fernández-Pérez de la Lastra et al., 2020; Turner & Lee-Kelley, 2013; Turner, Maylor, et al., 2013; Turner et al., 2015; Turner et al., 2016). In contrast, other empirical studies rather found a *positive and direct role* of human capital in the pursuit of exploration and other ambidexterity outcomes (e.g., (Gürlek, 2020; Kang et al., 2012; Kengatharan, 2020; Kostopoulos et al., 2015; Mahmood & Mubarik, 2020). Thus, based on the above discussion, the following hypotheses are proposed:

H1: *Human capital influences social capital positively and significantly.*

H2: *Human capital influences organisational capital positively and significantly.*

Social capital, being at the group level, plays a *dual role* in the hierarchical alignment. It not only acts as a frontline, primary, interactive, and dominant knowledge asset to affect ambidexterity outcomes, but also acts as a secondary and complementary knowledge asset to support organizational capital in the pursuit of ambidexterity outcomes by transferring its organic knowledge into organisational capital structures over the time. The knowledge embedded in the

groups and networks (social capital) is constructed as a result of collaborations and interactions among internal and external group members or stakeholders (Subramaniam & Youndt, 2005; Tsai & Ghoshal, 1998). Knowledge created, shared, utilised, and acquired in and amongst the groups, departments, and the people becomes part of the organisational capital, i.e., organisational memory, routines, processes, manuals, and methods over the time (Hargadon & Sutton, 1997; Jansen, Van Den Bosch, & Volberda, 2006; Subramaniam & Youndt, 2005; Tsai & Ghoshal, 1998). The alignment on the dual role of social capital is supported by the findings of the previous empirical studies on intellectual capital and general innovation and organizational performance outcomes (Bontis, 1998; Bontis et al., 2000; Chen et al., 2014) as well as by the empirical studies on the subject-matter of the current study (see Table 1; e.g., (Duodu & Rowlinson, 2019; Kang & Snell, 2009; Turner et al., 2015; Turner et al., 2016)). Therefore, we hypothesise as follows:

H3: *Social capital influences organisational capital positively and significantly.*

The impacts of organizational capital and social capital on ambidexterity outcomes are specifically and primarily in line with the contextual form of ambidexterity whereby employees pursue exploration and/or exploitation as they see fit according to their job requirements and 'context' (Birkinshaw & Gibson, 2004; Gupta, Smith, & Shalley, 2006; Raisch & Birkinshaw, 2008; Raisch et al., 2009; Turner et al., 2014; Turner, Maylor, et al., 2013). The principle of contextual ambidexterity suggests that the following four antecedents can be regarded as the attributes of an organisation's context and employee behaviour: stretch, discipline, support, and trust (Fu et al., 2016; Ghoshal & Bartlett, 1994; Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008). These antecedents can be categorised as hard elements (discipline and stretch) and soft element (support and trust). Gibson and Birkinshaw (2004) empirically demonstrated that the organizations who are successful in the pursuit of ambidexterity effectively manage the balance between hard elements and soft elements effectively. The development of social capital and its *dual role* in the pursuit of ambidexterity outcomes is in line with the soft elements (trust and support) while the development of organizational capital and its frontline and interactive role in the pursuit of ambidexterity is in line with the hard elements (discipline and trust) (Birkinshaw & Gibson, 2004; Fu et al., 2016; Ghoshal & Bartlett, 1994; Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008).

The soft elements enable strong relationships and consistent social interactions and collaborations among employees and other internal and external stakeholders across different groups and networks. These interactions and collaborations can lead to two knowledge outcomes. First, the members can help each other in seeking and using existing knowledge and other resources (Collins & Smith, 2006; Fu et al., 2016; Gabbay & Zuckerman, 1998; Wasko & Faraj, 2005). This existing-knowledge sharing promotes knowledge utilisation, reuse, and refinement both collaboratively and individually during day-to-day activities, i.e., *exploitation* (Collins & Smith, 2006; Fu et al., 2016). Second, knowledge regarding the future demands, challenges, and opportunities of an organizations can also be constructed and created as a result of collaborations and interactions in the groups and networks, thereby facilitating *exploration* (Bontis, 1998; Hargadon & Sutton, 1997; Subramaniam & Youndt, 2005; Sutton & Kelley, 1997; Tsai & Ghoshal, 1998). The diverse groups and networks comprised of internal and external stakeholders offer opportunities for cross-functional knowledge creation (Adler & Kwon, 2002; Kostopoulos et al., 2015; Lin et al., 2017; Tiwana, 2008). Furthermore, collaborations and interactions in the groups and network reduce the equivocality or ambiguity that, in turn, is a necessary requirement in the pursuit of exploration (Kang et al., 2012; Mom, van den Bosch, & Volberda, 2009). Thus, the following hypotheses are proposed:

H4: *Social capital influences exploitative learning positively and significantly.*

H5: *Social capital influences explorative learning positively and significantly.*

H6: *Social capital influences organisational ambidexterity positively and significantly.*

The current study postulates that the organizational capital, being at the organizational level, plays the role of a frontline and primary knowledge asset in the pursuit of ambidexterity outcomes in Bontis (1998) theory or model of alignment of knowledge assets. The literature supports that the organisational capital significantly promotes exploitation. However, there are contradictory findings and accounts concerning its potential to pursue exploration and thus ambidexterity. The development of organizational capital is in line with the hard elements of context (discipline and stretch) and especially the element of *discipline*. Employees (human capital) make disciplined use of (adapt or adopt) the existing organizational knowledge/capital –

knowledge they found effective in the past during individual and group tasks (human capital and social capital) that became part of the organizational knowledge/capital over the time (Fu et al., 2016; Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008). When employees adapt the knowledge, they thus refine (stretch) the existing knowledge or pursue exploitation (March, 1991; Raisch & Birkinshaw, 2008).

The findings of the empirical studies on knowledge assets and ambidexterity as reported in the Table 1 suggest that the organisational capital facilitates organisations in the pursuit of exploitation strategies (e.g., (Fernández-Pérez de la Lastra et al., 2020; Fu et al., 2016; Kang et al., 2012; Katila & Ahuja, 2002; Kostopoulos et al., 2015; Lin et al., 2017; Mahmood & Mubarik, 2020; Subramaniam & Youndt, 2005)). The underlying argument of these studies is that the organisational capital is *mechanistic* by its very nature (Kang & Snell, 2009) unless organizations change its nature to *organic* or find balance between organic organizational capital and mechanistic organizational capital in the form of *versatile and flexible organizational capital* or *ambidextrous organizational capital* (Fernández-Pérez de la Lastra et al., 2020; Lakshman et al., 2017; Turner et al., 2015; Turner et al., 2016). Hence, organizational capital in its mechanistic form can shape the behaviour, patterns, and frames of reference of the employees to search for existing knowledge and pursue exploitation (Crossan, Lane, & White, 1999; De Boer, Van Den Bosch, & Volberda, 1999; Kang et al., 2012; Katila & Ahuja, 2002; Subramaniam & Youndt, 2005). According to Kang and Snell (2009), organisational capital is essentially mechanistic in nature. It thus usually facilitates knowledge use, reuse, and subsequent knowledge refinement or exploitation. It ensures that the employees can access, share, and utilise already accumulated and codified knowledge (Kostopoulos et al., 2015; Subramaniam & Youndt, 2005; Youndt et al., 2004). The search for existing knowledge leads not only to the knowledge use and reuse, but also to the *incremental refinement* of the existing knowledge stocks in the organizational capital in case existing knowledge fails to deliver solutions. In such a case of knowledge failure, depending upon the quality of the human capital and the social capital, employees may seek knowledge or solutions of the problems within or outside the domains of the existing knowledge in the organizational capital (Hsu & Wang, 2012; Katila & Ahuja, 2002; Lin et al., 2017; Subramaniam & Youndt, 2005; Swart & Kinnie, 2010). Therefore, we hypothesise that:

H7: *Organisational capital influences exploitative learning positively and significantly.*

Given the universally recognized role of social capital in the pursuit of ambidexterity outcomes (Table 1; e.g., (Kang & Snell, 2009; Subramaniam & Youndt, 2005)) and supportive role of human capital to organizational capital, the current study postulates that the Bontis (1998) model of alignment between knowledge assets positions organizational capital in such a frame that the fresh and organic knowledge stocks embedded in the human capital and social capital continuously translate into and transform it to an ambidextrous or a versatile and flexible form of organizational capital that is balanced between organic and mechanistic organizational capital (Fernández-Pérez de la Lastra et al., 2020; Kang & Snell, 2009; Subramaniam & Youndt, 2005; Turner et al., 2016). Thus, organizational capital in this form does not program and trap employees to pursue locally bounded and myopic *exploitative learning*, and thus does not stop them from pursuing *explorative learning*. Instead, it signals them in the face of exploratory problem-solving to seek (stretch) solutions (Birkinshaw & Gibson, 2004) beyond the domains of existing knowledge assets (Fu et al., 2016; Ghoshal & Bartlett, 1994; Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008). A range of qualitative and quantitative empirical studies support Bontis (1998) argument on the pursuit of organizational capital alone or in combination with the human capital and/or social capital (Duodu & Rowlinson, 2019; Fernández-Pérez de la Lastra et al., 2020; Fu et al., 2016; Lin et al., 2017; Mahmood & Mubarik, 2020; Turner et al., 2015; Turner et al., 2016). For example, Duodu and Rowlinson (2019) found that the human capital does not affect the pursuit of exploration and exploitation while organizational capital does so. On the other hand, empirical studies in the veins of Kang and Snell (2009) and Subramaniam and Youndt (2005) models of alignment between knowledge assets either postulate no effect of organizational capital on exploration and ambidexterity (Kang et al., 2012; Subramaniam & Youndt, 2005) or find a negative effect of organizational capital on unit ambidexterity (Kostopoulos et al., 2015).

Therefore, the following hypotheses are proposed:

H8: *Organisational capital influences explorative learning positively and significantly.*

H9: *Organisational capital influences organisational ambidexterity positively and significantly.*

H10: *Organisational capital mediates between social capital and exploitative learning partially and significantly.*

H11: *Organisational capital mediates between social capital and explorative learning partially and significantly.*

H12: *Organisational capital mediates between social capital and organisational ambidexterity.*

3. Methods

3.1 Samples and sampling procedures

This study collected data from various businesses in South Korea, including those in the manufacturing, construction, distribution and logistics, information technology, finance, and service industries to test the hypotheses. This is because the development of the Korean innovation models lies in the pursuit of organizational learning and innovation ambidexterity (Ali & Park, 2016). The Korean firms have increasingly recognised the innovation-related advantages as a result of pursuing knowledge assets for ambidexterity (Kim, 1997). All sampled firms have similar applications and organisational resources to alleviate the potential moderating effects of the economy and industry.

The primary data were collected through a self-administered questionnaire from the members of the middle and top management in the South Korean firms. The respondents were familiar with their firm's processes, routines, information, and learning initiatives (Ali & Park, 2016; Lin et al., 2017; (Subramaniam & Youndt, 2005). The roles of these individuals are to transform knowledge across various organisational levels. The middle managers are central to the knowledge creation process, as they rationalise top management plans and develop primary value-adding processes (line management) in a progressive unit (Baskerville & Dulipovici, 2006). The data for both independent and dependent variables were collected from the multiple sources. A middle manager-senior manager dyadic design was used in line with the previous studies on the subject-matter (Lin et al., 2017; Subramaniam & Youndt, 2005) and on the assumption that although top executives are typically the primary decision-makers in organisational change, they only represent one part of the daily flow of knowledge within and across different units (Lin et al.,

2017; Subramaniam & Youndt, 2005). A professional research consultancy firm, aware of the objectives of the current study, was hired for data collection. The consultants provided a list of firms located in Seoul and six other metropolitan cities of South Korea (Busan, Incheon, Daegu, Daejeon, Gwangju, and Ulsan).

To avoid potential common method variance bias associated with the use of self-administered and self-reporting surveys, the guidelines of (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) were followed. Thus, two separate survey questionnaires were developed to collect data on independent and dependent variables separately. The hard copies of the questionnaires were delivered to 800 selected firms having middle and senior managers. The questionnaire prepared for middle-level managers assessed organisations' knowledge assets while questionnaire for senior-level managers/executives measured organizational explorative learning and exploitative learning.

The data collection was carried out between March and July 2018, and 424 usable middle-senior managers dyads were collected. A total of 992 middle managers (sample ranging from 1 to 5 within the same or different departments) and 462 senior managers responded. However, responses from 38 firms were dropped from the senior managers' sample due to mismatching dyads and missing values. In terms of geographic location, the response rates from the firms in Seoul, Busan, Incheon, Daegu, Daejeon, Gwangju, and Ulsan were 69%, 56%, 68%, 42%, 43%, 37%, and 41%, respectively. For the middle manager sample, an average score approach was used for the responses from the same firm to obtain firm scores for the organizational-level variables.

Among the respondent firms, 49.5% were private enterprises, 20% joint companies, 15.6% foreign capital firms, and 14.9% public enterprises. In terms of business sector, 36.3% were in the banking and financial services industry, 25.9% in manufacturing, 11.8% in distribution/logistics, 11.1% in information technology, 9.2% in construction, and 5% in other services. In terms of employee number, 23.7% of the firms had fewer than 299 employees, 16.5% had between 300 and 4,999 employees, and 12.5% had more than 5,000 employees. In terms of revenue, 59% of the firms brought in between 50 and 99 billion KRW, 24.5% between 100 and 999 billion KRW, 10.4% between 1,000 and 9,000 billion KRW, and 6.1% more than 10,000 billion KRW (1 USD = 1,134.45 KRW).

The intra-class correlation was assessed to calculate the inter-rater reliability of the multiple respondents for the variables. The average Cronbach's alpha was 0.72, indicating an acceptable inter-rater consistency among the multiple respondents. The selection of respondents was unlikely to be a concern, as they were drawn from a random selection of firms. Following Lewis, Hardy, and Snaith (2013), we conducted a multivariate analysis of variance to check for potential nonresponse bias. The differences between early and late responding firms were assessed in terms of several firm characteristics, such as age, number of employees, revenue, and firm performance. However, no such significant differences were found (Wilks's $\lambda = 0.98$, $F = 1.43$, $p = 0.59$) (Combs & Ketchen, 1999).

3.2 Measurement

In line with the operational definitions of the variables provided in the introduction, various previously validated scales were adapted to fit the research context (Table 2). The survey questionnaire design was based on the literature review. A 7-point Likert scale ranging from *strongly disagree* (1) through *undecided* (4) to *strongly agree* (7) was used for all constructs (Table 2). The original survey questionnaire was first prepared in English and then translated into Korean. Appropriate measures were taken to ensure conceptual equivalence, understandability, and content validity in the translation process. The Korean version was pilot tested with three professors, five Ph.D. students with professional experience in the target industries, and four managers having extensive business experience to ensure the content validity and appropriateness of the survey questionnaire in the Korean context. Further, ten professionals across various sectors reviewed the questionnaire to determine whether there were any problems with the design. Based on the feedback from these professionals, minor modifications were made.

3.2.1 Knowledge assets

The responses from the middle managers were used to measure three types of the knowledge assets of the firms – human capital, social capital, and organizational capital (Bontis, 1998; Subramaniam & Youndt, 2005) The measurement scales were primarily based on Lin et al. (2017) and Subramaniam and Youndt (2005). The details are as follows. Five items were used to measure *human capital* that reflected overall skill, expertise, and knowledge levels of the

employees of a firm (Schultz, 1961). Social capital was measured using five items that reflected the main characteristics of social structures in an organization (Ghoshal & Bartlett, 1994). Four items were used to measure *organisational capital* that assessed the ability of a firm to stock knowledge in its hierarchical and non-hierarchical structures (Bontis, 1998; Subramaniam & Youndt, 2005).

3.2.2 Exploitation and exploration strategies

The responses of senior managers/executives were used to measure exploitative and exploratory learning strategies (Lin et al., 2017). Following seminal studies (He & Wong, 2004; March, 1991), 'exploitative learning' and 'exploratory learning' were operationalised as two distinct learning strategies. (Atuahene-Gima & Murray, 2007) scale was employed for the measurement such that each learning strategy was measured by the five items based on earlier research (March, 1991), which was subsequently applied by Zhao et al. (2016). The scale of exploitative learning captured the competency, efficiency, and reliability in searching for intellectual capital within an organisation, based on existing knowledge within the familiar product and market domains in which the firm has already accumulated experience. The scale of exploratory learning measured an organisation's efforts to search for entirely new intellectual capital beyond the scope of its current experience.

3.2.3 Ambidexterity

The approaches to measuring ambidexterity include assessing the difference between exploitation and exploration (Cao, Gedajlovic, & Zhang, 2009), their product (He & Wong, 2004), or their combined values (Lubatkin, Simsek, Ling, & Veiga, 2006). He and Wong (2004) product approach was followed to avoid multi-collinearity. It is in line with the previous studies (Cao et al., 2009, Lin et al., 2017). Hence, to measure ambidexterity, the mean-centred scores of exploitative and exploratory learning strategies were multiplied (Lin et al., 2017).

3.3 Control variables

Various organisational and industrial factors were included as control variables in the model, including firm size, revenue, ownership structure, and industry type, due to their potential

effects on ambidexterity outcomes (Lin et al., 2017). 'Firm size' refers to the number of employees in a firm, as measured with an ordinal 3-point scale. Firm revenue was introduced and measured with an ordinal 4-point scale. Ownership structure was operationalized through three dummy variables: public enterprise, joint company, and foreign capital firm. We considered ownership structure because past studies indicated that the grounds of ambidexterity in the public sector organizations might be different from other ownership structures (Boukamel & Emery, 2017; Matheus & Janssen; Palm & Lilja, 2017; Smith & Umans, 2015). A composite model was formed from these dummy variables, with private enterprise as the reference level. Industry type was similarly measured using a composite model comprised of five dummy variables: banking and financial services, distribution/logistics, information technology, construction, and other services. Manufacturing was coded as a reference category with the value of zero for comparison.

3.4 Data analysis

In this study, data analysis is carried out by employing structural equation modelling (SEM) technique. The SEM approach is applied to simultaneously examines the reliability and validity of the measurement model and the association among the latent variables in the structural model (Hair, Hult, Ringle, & Sarstedt, 2017). Presently, two SEM techniques – covariance-based SEM (CB-SEM) and variance-based SEM (PLS-SEM) – are popular (Joe F. Hair, Sarstedt, Ringle, & Mena, 2012; Joreskog, 1982; Richter, Cepeda-Carrion, Roldán Salgueiro, & Ringle, 2016; Rigdon, Sarstedt, & Ringle, 2017; Sarstedt, Hair, Ringle, Thiele, & Gudergan, 2016). Considering the research objective in this study, partial least squares SEM (PLS-SEM) - a type of SEM is adopted instead of multiple regression analysis or CB-SEM. It is more appropriate statistical approach for the following reasons. First, PLS-SEM is considered as more appropriate tool for prediction-oriented research studies (Cepeda-Carrion, Cegarra-Navarro, & Cillo, 2019; Chin, 2010; Joe F. Hair et al., 2012; Richter et al., 2016; Sarstedt et al., 2016). In this study, the objective of theoretical model focuses on prediction and explaining the variance in key target constructs (i.e., organisational capital, exploitative and explorative learning, and organisational ambidexterity). Second, PLS-SEM is an appropriate technique for analysing SEM comprising of complex structural relationships (Richter et al., 2015; Sarstedt et al., 2016). The theoretical model in this study reflects relatively a complex structural association with three series of direct

relationships and three set of indirect relationships (Chin, 2010; Richter et al., 2015). Finally, PLS-SEM is suitable tool for testing model which in early stage of theory development or extension (Richter et al., 2015; Sarstedt et al., 2016). The theoretical model in this study is distinct from previous models and empirical studies, thus provides the opportunity for new phenomena to be explored and developed (Richter et al., 2015). PLS-SEM has been used in similar studies (Bontis, 1998). SmartPLS 3.2.7 software (Ringle, Wende, & Becker, 2015) was used for employing PLS path modelling. The PLS algorithm and basic settings, such as a weighting scheme (path) with a maximum number of 300 iterations, and a stop criterion of 10^{-7} (=1.0E-07) were used (Hair et al., 2017). The significance levels of the path coefficients, *t*-statistics, *p*-, and the corresponding 95% bias-correlated and accelerated (BCa) bootstrap confidence intervals were obtained using the PLS algorithm bootstrapping procedure with subsamples of 5000 and using no sign changes.

4. Results and analysis

4.1 Measurement model assessment

The measurement model (i.e., the constructs) was assessed based on the standard guidelines of Hair et al. (2017). The validity and reliability of each individual item was established, as the standardised factor loadings ranged from 0.70 to 0.88 with high levels of significance (Table 2). These values are well above the threshold value of 0.70 (Fornell & Larcker, 1981). Construct reliability was confirmed by analysing three types of reliability. The coefficients of Cronbach's alpha, composite reliability, and Dijkstra-Henseler's rho (ρA) ranged from 0.84 to 0.90, 0.89 to 0.93, and 0.85 to 0.91, respectively (Table 2). These values are well above the recommended level of 0.70 and thus confirm the reliability of all six constructs (Chin, 1998). The average variance extracted (AVE) determined the convergent validity, which is the sum of variance a construct gains from its associated items with relation to the measurement variance (Fornell & Larcker, 1981). The AVE values ranged from 0.66 to 0.72, which are above the recommended threshold of 0.50 (Table 2). Finally, discriminant validity was established by using the Fornell-Larcker criterion and heterotrait-monotrait (HTMT) ratio of correlation. The values of the square root of AVE, as given on the diagonal in Table 3, were greater than each correlation value between all the other constructs in the corresponding rows and columns (Henseler, Ringle, & Sarstedt, 2015). Hence, the Fornell-Larcker criterion for discriminant validity was met (Fornell & Larcker, 1981). Finally, the HTMT

values were acceptable (Henseler et al., 2015) as they were below the recommended level of 0.90 (see the values above the diagonal in Table 3).

***********please insert Table 2 about here**********

Table 3 shows the means, standard deviations, and correlations (below the diagonal) for all six constructs as well as the values of the AVE square root on the diagonals. The mean values indicate that all the constructs are generally above the mid-point, and the correlations amongst the constructs are positive. Thus, multicollinearity is not a concern in this study (Hair et al., 2017).

***********please insert Table 3 about here**********

4.2 Structural model assessment

The standard criteria (J. F. Hair, Hult, Ringle, & Sarstedt, 2017) were followed for the assessment of the structural model. All the estimations and key parameters were significantly acceptable, as shown in the Figure 3 and Tables 4-6. Hence, all the hypotheses of this study are accepted. To avoid any bias in the path coefficient estimation, collinearity among the exogenous constructs was examined. The results in Table 2 demonstrate the lack of collinearity, because for all the exogenous constructs, the variance inflation factor (VIF) values ranged from 2.26 to 3.23. These values are less than threshold value of 5 (J. F. Hair et al., 2017). The assessment of structural model included the predictive relevance Q^2as well, which was measured using the blindfolding technique with an omission distance of 7 for every endogenous construct (Hair et al., 2017). The blindfolding procedure yielded Stone-Geisser-Criterion Q^2 values, which represent the cross-validated redundancy of reflective endogenous constructs. Table 5 shows that the Q^2 values are all above zero (Hair et al., 2017), supporting the predictive relevance of the proposed model in terms of out-of-sample prediction. Third, the results of Q^2 were supported by the values of the coefficient of determination (R^2). Table 4 shows the values of R^2 that suggest that the structural model has satisfactory in-sample predictive power (Sarstedt, Ringle, Henseler & Hair, 2014). The results of $Q^2$and R^2 were further supported when the goodness-of-fit of the model was examined. The adjusted R^2 values of the social capital, organisational capital, and ambidexterity outcomes, while accounting for the control variables, were far greater than those of the previous studies on the subject-matter (Table 5; Refer to quantitative empirical studies in the Table 1 such as (Duodu &

Rowlinson, 2019; Kang et al., 2012; Lin et al., 2017{Kang, 2012 #11; Subramaniam & Youndt, 2005)).

***********please insert Figure 3 about here**********

The effect size f^2 was also measured to assess the relative impact of a predictor (exogenous) construct on an endogenous construct (Hair et al., 2017). The effect size f^2 helps to assess whether a predictor variable has a substantive influence on the dependent variable's R^2. The values of 0.02, 0.15, and 0.35 for the effect size f^2 can be regarded as small, medium, and large (Chin, 1998). These values were measured using the following formula: $f^2 = (R^2_{included} - R^2_{excluded})/ (1- R^2_{included})$. Table 4 reports the results for the effect size f^2. *Surprisingly, the effect sizes of organisational capital were higher than those for social capital, lending additional support to the arguments proposed in the study (Table 4).*

The value of the standardised root means square residual (SRMR) can be used as a goodness-of-fit measure for PLS path modelling. The SRMR value was 0.05, which satisfied the threshold limit of less than 0.08 given that a zero value indicates the perfect model fit. The SRMR also confirmed the overall goodness-of-fit measure for validating the model (Hair et al., 2017). A path analysis that reflected the hypotheses was then conducted. The indicators of the significance of the path coefficients suggested that all the hypotheses be accepted (Refer to Figure 3 and Table 4). Consistent with H1 and H2, the empirical results showed that human capital has a positive and significant influence on social capital (H1: $\beta = 0.77^{***}$; $t = 32.80$; $p < 0.001$; CI $_{0.95\% \text{ BCa}}$: [0.73, 0.81]) and organisational capital (H2: $\beta = 0.50^{***}$; $t = 8.86$; $p < 0.001$; CI $_{0.95\% \text{ BCa}}$: [0.40, 0.58]). H1 and H2 were, therefore, accepted. Social capital had a positive and significant influence on organisational capital (H3: $\beta = 0.33^{***}$; $t = 5.30$; $p < 0.001$; CI $_{0.95\% \text{ BCa}}$: [0.23, 0.44]), exploitative learning (H4: $\beta = 0.32^{*}$; $t = 4.55$; $p < 0.05$; CI $_{0.95\% \text{ BCa}}$: [0.21, 0.44]), explorative learning (H5: $\beta = 0.16^{*}$; $t = 2.36$; $p < 0.05$; CI $_{0.95\% \text{ BCa}}$: [0.05, 0.27]), and ambidexterity (H6: $\beta = 0.27^{***}$; $t = 4.34$; $p < 0.001$; CI $_{0.95\% \text{ BCa}}$: [0.17, 0.37]). Thus, H3, H4, H5, and H6 were also supported. Organisational capital had a positive and significant influence on exploitative learning (H7: $\beta = 0.44^{***}$; $t = 6.11$; $p < 0.001$; CI $_{0.95\% \text{ BCa}}$: [0.31, 0.55]), explorative learning (H8: $\beta = 0.55^{***}$; $t = 9.01$; $p < 0.05$; CI $_{0.95\% \text{ BCa}}$: [0.44, 0.64]), and ambidexterity (H9: $\beta = 0.49^{***}$; $t = 8.39$; $p < 0.001$; CI $_{0.95\% \text{ BCa}}$: [0.39, 0.58]). Thus, H7, H8, and H9 were also supported.

***********please insert Table 4 about here**********

***********please insert Table 5 about here**********

4.3 Mediation analysis

The research framework in this study (Figure 2) reflected a mediated model. Zhao, Lynch Jr, and Chen (2010) suggested that the key condition required for mediation to occur is a significant indirect effect of an independent variable on a dependent variable through another transmitting variable. This study followed the mediation analysis procedure used and recommended by Carrión, Nitzl, and Roldán (2017), Klarner, Sarstedt, Hoeck, and Ringle (2013), and J. F. Hair et al. (2017). The research framework was first estimated without the mediator (i.e., organisational capital). The direct influences of social capital on exploitative learning ($\beta = 0.63^{***}$; $t = 17.57$; $p < 0.001$; CI $_{0.95\%\ BCa}$: [0.57, 0.69]), explorative learning ($\beta = 0.52^{***}$; $t = 12.95$; $p < 0.001$; CI $_{0.95\%\ BCa}$: [0.48, 0.62]), and ambidexterity ($\beta = 0.62^{***}$; $t = 17.71$; $p < 0.001$; CI $_{0.95\%\ BCa}$: [0.65, 0.68]) were strong and significant as shown in the Appendix A (Figure1). Organisational capital was then included as the mediator.

Consistent with H10, the indirect influence of social capital via organisational capital on exploitative learning was significant ($\beta = 0.15^{***}$; $t = 4.27$; $p < 0.001$; CI $_{0.95\%\ BCa}$: [0.10, 0.20]), and its direct influence on exploitative learning ($\beta = 0.32^{***}$; $t = 4.60$; $p < 0.001$; CI $_{0.95\%\ BCa}$: [0.21, 0.44]) remained significant. Thus, 31.91% of the variance was accounted for VAF(which determines the size of the indirect effect in relation to the total effect, i.e., direct effect + indirect effect). Thus, organisational capital partially mediated the social capital-exploitative learning relationship, as shown in Table 5. Thus, H10 was accepted. As hypothesised in H11, the indirect influence of social capital via organisational capital on explorative learning was significant ($\beta = 0.18^{***}$; $t = 4.61$; $p < 0.001$; CI $_{0.95\%\ BCa}$: [0.12, 0.25]), and its direct influence on explorative learning ($\beta = 0.16^{**}$; $t = 2.37$; $p < 0.01$; CI $_{0.95\%\ BCa}$: [0.10, 0.28]) remained significant. Thus, with 52.94% of the VAF, organisational capital partially mediated the social capital-explorative learning relationship, as shown in Table 5. Therefore, H11 was accepted. Finally, as predicted by H12, the indirect influence of social capital via organisational capital on ambidexterity was significant ($\beta = 0.17^{***}$; $t = 4.68$; $p < 0.001$; CI $_{0.95\%\ BCa}$: [0.11, 0.22]), and its direct influence on

ambidexterity (β = 0.27***; t = 4.34; p < 0.001; CI $_{0.95\%\ BCa}$: [0.17, 0.37]) remained significant. Thus, with 38.64% of the VAF, organisational capital partially mediated the social capital-ambidexterity relationship, as shown in Table 5. Therefore, H12 was accepted. These results suggest that organisational capital did have a mediating role.

***********please insert Table 6 about here**********

5. Discussion and conclusion

This study based on the data from South Korean firms established and advanced Bontis (1998) model of knowledge assets as one of the promising models of knowledge assets for pursing organizational ambidexterity outcomes [ambidexterity, exploration, and exploitation] or the form(s) of ambidexterity an organization choose(s) [contextual, temporal, and structural forms of ambidexterity]. Several theoretical and empirical studies at various levels of analysis (e.g., operational, individual, project, and organizational) proposed, explored, and examined different architectures, models, or configurations between knowledge assets to achieve ambidexterity outcomes(s) (Refer to Table 3) using respective form(s) of ambidexterity (e.g., (Duodu & Rowlinson, 2019; Gürlek, 2020; Kang & Snell, 2009; Kang et al., 2012; Kengatharan, 2020; Kostopoulos et al., 2015; Lakshman et al., 2017; Lin et al., 2017; Mahmood & Mubarik, 2020; Subramaniam & Youndt, 2005; Turner & Lee-Kelley, 2013; Turner, Maylor, et al., 2013; Turner et al., 2016)). Kang and Snell (2009) and Subramaniam and Youndt (2005) are two prominent models of knowledge assets at *the organizational levels* that have proposed respective architectures or alignments between knowledge assets to pursue respective ambidexterity outcome(s) using respective form(s) of ambidexterity. Majority of the empirical studies on the subject-matter at the organizational levels of analysis drew on either of the two models (e.g., (Diaz-Fernandez et al., 2017; Duodu & Rowlinson, 2019; Kang et al., 2012; Kengatharan, 2020; Kostopoulos et al., 2015; Lakshman et al., 2017; Lin et al., 2017; Mubarik et al., 2019); see Table 1 for in-depth detail). In this vein, while acknowledging all possible methodological choices of this study, we put forward Bontis (1998) model of knowledge assets amongst other models at the organizational level (e.g., (Kang & Snell, 2009; Subramaniam & Youndt, 2005)) that can pursue all three form(s) of ambidexterity.

Bontis (1998) alignment between knowledge assets outlines following paths for the organizational managers that how they can align, position, or interconnect their organizational knowledge assets existing at different levels in order to jointly exploit them for pursuing ambidexterity outcomes. First, it puts forward human capital as a complementary, facilitative, and supportive knowledge asset to social capital and organizational capital. Thus, the current study gives rise to the notion that having employees that are equipped with the relevant fresh and organic knowledge and experience does not itself lead to the effective pursuit of ambidexterity outcomes until their knowledge is shared into, refined by, and used in the groups and the organizational hierarchical and non-hierarchical structures (Bontis, 1998). In fact, this notion is consistent with the star workers theory that the star workers cannot replicate their star performance in a new organization as a result of their turnover. This is because their performance in the former organization is a function of the supporting organizational mechanisms and group(s) around them rather their talent itself (Groysberg, Lee, & Nanda, 2008).

Second, organizational capital acts as a *frontline knowledge asset* that is supported by the human capital and organizational capital in the pursuit of ambidexterity outcomes. This notion is consistent with a range of empirical studies that demonstrated that the organizations can also have *ambidextrous* or flexible and versatile form of organizational capital that is balanced between *mechanistic organizational capital* and *organic capital* (Kang & Snell, 2009) and thus has the ability to pursue three ambidexterity outcomes (Duodu & Rowlinson, 2019; Fernández-Pérez de la Lastra et al., 2020; Lakshman et al., 2017; Turner et al., 2015; Turner et al., 2016). Hence, organizational capital, when supported by human capital and social capital, does not promote rigidity and cognitive homogeneity among ambidextrous employees to trap them in the domains of existing knowledge assets and stop them from pursuing exploration. Instead, it signals and gives a context or frame of reference for them to stretch and seek solutions beyond present knowledge boundaries (Birkinshaw & Gibson, 2004) beyond the domains of existing knowledge assets (Fu et al., 2016; Ghoshal & Bartlett, 1994; Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008). Finally, the results advanced our understandings that the high input and participation of the human capital in different internal, external, and cross-sectional networks and groups enables the social capital to play a *dual and a dynamic role*. Therefore, it can not only pursue ambidexterity outcomes as a *frontline knowledge asset* but also translates its organic and fresh knowledge alongside human

capital into the organizational capital. Thus, social capital acts as a *complementary knowledge asset* such that the organizational capital specifically and knowledge assets in general do not become mechanistic or rigid to affect exploration and ambidexterity outcomes negatively. This *dual role* of social capital is consistent with Kang and Snell (2009) and Subramaniam and Youndt (2005) models of alignment between knowledge assets.

5.1 Theoretical implications

This study has various theoretical implications specifically for the management of knowledge assets and knowledge processes and generally for the management of physical assets with respect to the assertions of Bontis (1998) model of alignment between knowledge assets. First, the future studies should not conceptualize knowledge assets in isolation. The alignment or interplay among the knowledge assets rather should be considered. This is important because different knowledge assets at different levels are interrelated with and interdependent on each other to make their joint deployment and leverage. The various alignments between them might have already been available in the existing literature especially in the seminal sources but have not been used. For example, the current study identified Bontis (1998) model of alignment between knowledge assets as a seminal source in the existing literature and extended its use in the pursuit of ambidexterity outcomes. It should be further noted in the vein of alignment theory that not every knowledge asset is supposed to affect value creation outcomes directly. Some knowledge assets can be supportive and complementary to other knowledge assets whose role, in turn, can be frontline and primary to pursue value creation outcomes directly. These implications of alignments can also be extended to the literature on knowledge management processes and management of physical assets. Second, when organizational capital is supported by the human capital and the organizational capital, can act as a frontline knowledge asset to pursue ambidexterity outcomes. Therefore, in line with earlier qualitative research studies (Fernández-Pérez de la Lastra et al., 2020; Lakshman et al., 2017; Turner et al., 2015; Turner et al., 2016), ambidextrous organizational capital – balanced between mechanistic organizational capital and organic organizational capital – might be conceptualized and used in the future empirical quantitative studies. The present subject-matter *empirical quantitative studies* seem to ignore such a conceptualization and measurement of organizational capital (Refer to Table 1). Like organizational ambidexterity (He

& Wong, 2004; Lin et al., 2017), the ambidextrous organizational capital can be calculated as a product or addition of organic organizational capital and mechanistic organizational capital. Finally, human capital, being at the individual level, might not be a frontline but a supportive knowledge asset in the pursuit of ambidexterity outcomes. Therefore, it is best to exploit its knowledge and experience amongst the groups and the organizational structures, methods, processes, and systems to exploit them effectively.

5.2 Managerial implications

This study informs to the practicing managers that they can align knowledge assets of the firm in line with the Bontis (1998) model or architecture of knowledge assets to enable the pursuit of ambidexterity outcomes or the form(s) of ambidexterity they have chosen for their organizations. Human capital can be a supportive knowledge asset to social capital and organizational capital that, in turn, can pursue ambidexterity outcomes directly. This model of knowledge asset may require managers to employ effective HRM architectures and other managerial practices that ensure the recruitment and development of brilliant human capital (Diaz-Fernandez et al., 2017; Fernández-Pérez de la Lastra et al., 2017a; Hansen, Güttel, & Swart, 2019; Kang & Snell, 2009; Kang et al., 2012; Lakshman et al., 2017; Prieto-Pastor & Martin-Perez, 2015; Swart, Turner, Van Rossenberg, & Kinnie, 2019). Furthermore, this model also requires managers to implement various organizational mechanisms, such as supportive organizational culture, group dynamics, and individual and group autonomy, that not only enable human capital to support other two knowledge assets but also enable social capital to support organizational capital effectively. Finally, the managers should make sure that their organizational capital does not become mechanistic and rigid. Therefore, they should ensure different mechanisms or practices that ensure the flow of fresh and organic knowledge from the human capital and the social capital into the means of organizational capital that, in turn, transform organizational capital into an ambidextrous form.

5.3 Limitations and future research recommendations

This study has the following limitations and research recommendations. First, innovation ambidexterity has been assumed as an ex-post outcome of learning ambidexterity (He & Wong,

2004), however it was not considered in this study. The future studies should consider innovation ambidexterity to examine how organizations (can) use knowledge assets to achieve learning ambidexterity that, in turn, leads to innovation ambidexterity. Second, the means of accumulating knowledge assets, such as HRM and other managerial practices, were not considered in the current study (for example (Diaz-Fernandez et al., 2017; Fernández-Pérez de la Lastra et al., 2017a; Hansen et al., 2019; Kang & Snell, 2009; Kang et al., 2012; Lakshman et al., 2017; Prieto-Pastor & Martin-Perez, 2015; Swart et al., 2019)). Therefore, idiosyncratic HRM architectures and other managerial practices appropriate for implementing Bontis (1998) model should be explored and examined. We point that because Bontis (1998) model depends upon the seminal supportive role of human capital to social capital and organization capital, therefore managerial and HRM practices that are particularly relevant to the model should be explored and examined empirically. Third, the data were collected from specific firms and industries in the South Korean context. Therefore, the findings may not be generalisable to other contexts. In this vein, it is important that the future studies should explore whether findings of the current subject-matter differ between the organizations in the public sectors and the private sectors amongst other ownership structures (Boukamel & Emery, 2017; Matheus & Janssen; Palm & Lilja, 2017; Smith & Umans, 2015). Finally, confirmatory studies using covariance-based SEM (i.e., AMOS), multilevel studies using hierarchical linear modelling (Martín-de Castro, 2014), and configuration or asymmetrical modelling using fuzzy-set qualitative comparative analysis (fsQCA; (Martín-de Castro, Delgado-Verde, Amores-Salvadó, & Navas-López, 2013)) of knowledge assets may further add value and contributions in understanding whether and how different interplays of knowledge assets can lead to different ambidexterity outcomes under respective forms of ambidexterity.

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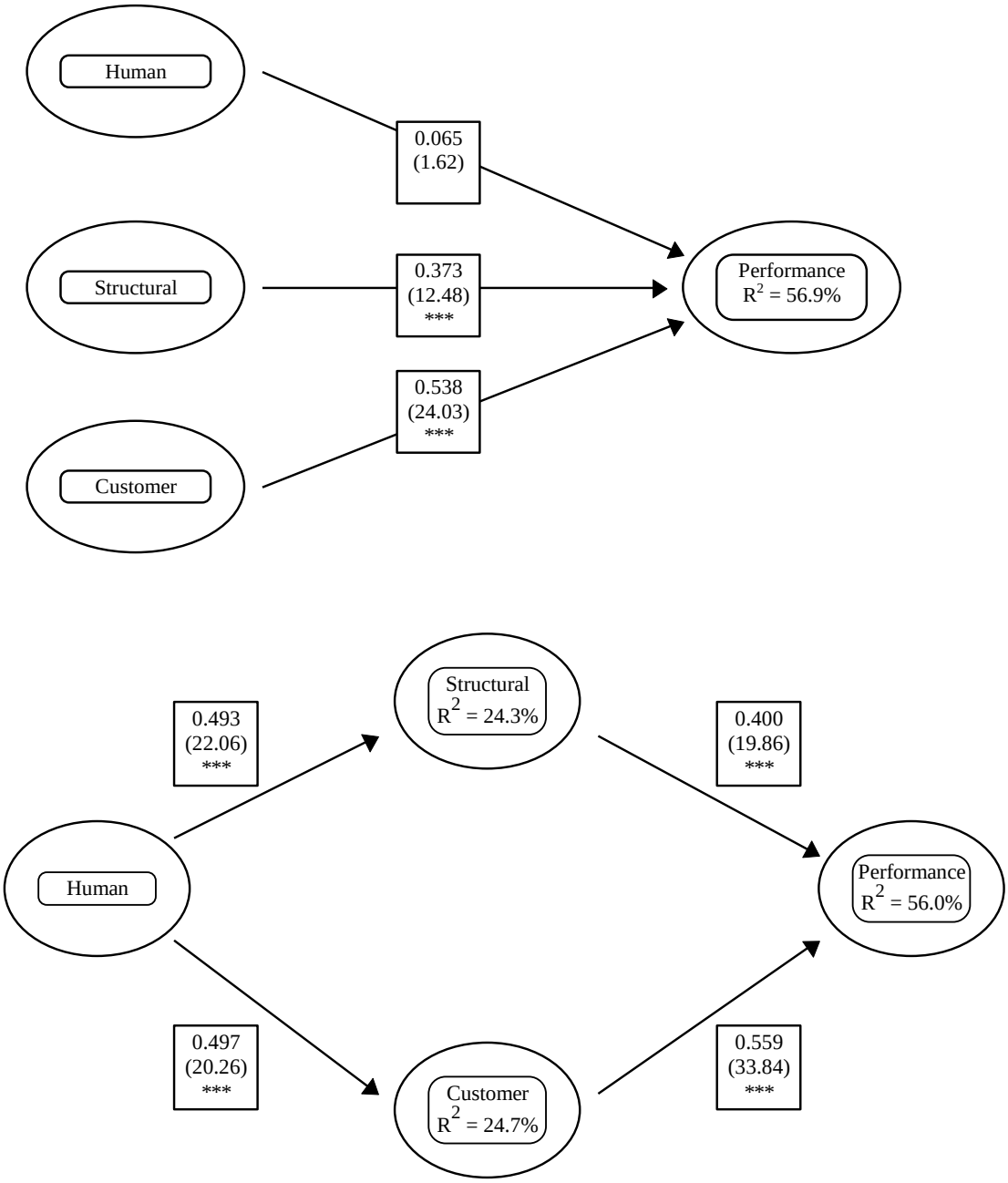
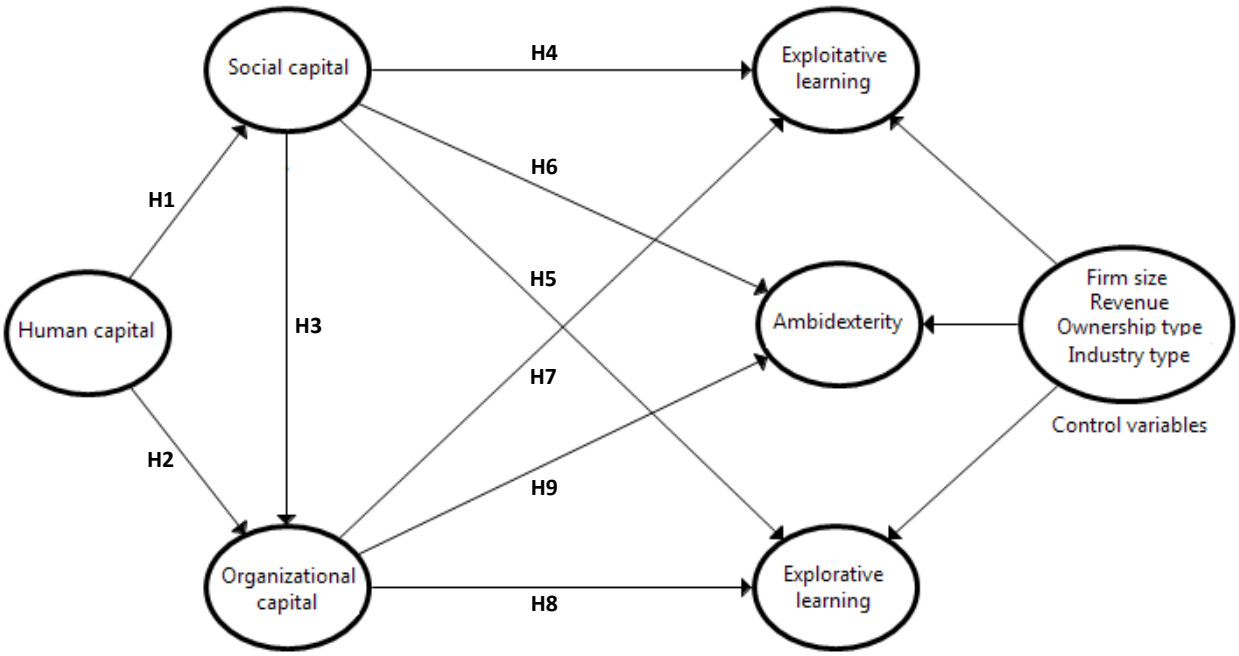


Figure 1. Bontis' (1998) simplistic and diamond research model (source Bontis (1998))



H10: Social capital → organisational capital → exploitative learning
H11: Social capital → organisational capital → explorative learning
H12: Social capital → organisational capital → organisational ambidexterity

Figure 2: Theoretical model

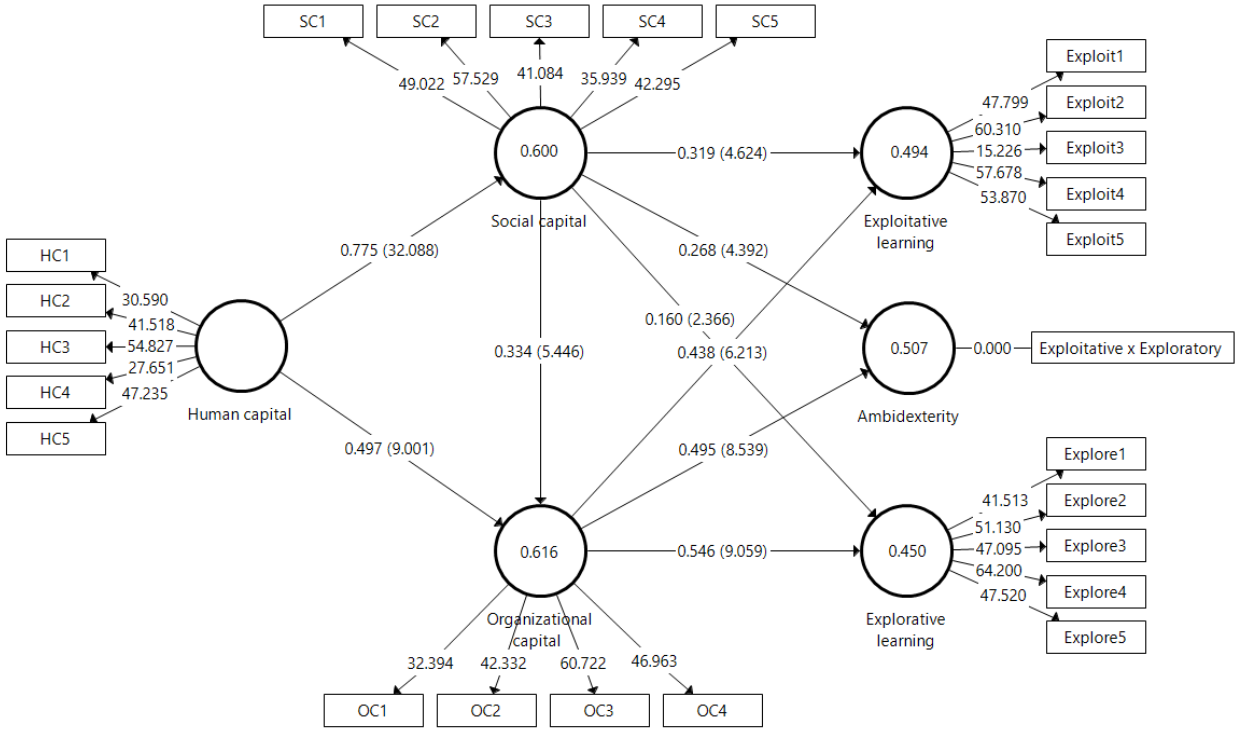


Figure 3: The results of partial least squares (PLS) path modeling

Table 1: Review of notable and relevant empirical studies on the use of knowledge assets in the pursuit of ambidexterity

S.No.	Study	The relevant focus	Research method	The relevant findings
1	Amankwah-Amoah and Adomako (2021)	The mediating role of contextual ambidexterity between knowledge integration and innovation performance	Quantitative data from 245 entrepreneurial firms in Ghana	Human resource slack moderates the relationship between knowledge integration and contextual ambidexterity. Contextual ambidexterity mediates between knowledge integration and innovation.
2	Kengatharan (2020)	The mediating role of organizational ambidexterity between firm-specific human capital and organizational productivity & performance	Data from 197 managers in Sri Lanka with self-reported questionnaires in a time-lagged approach	The mediating role of organizational ambidexterity between firm-specific human capital and organizational productivity & performance.
3	Mahmood and Mubarik (2020)	The individual effects of three dimensions of intellectual capital – human capital, relational capital, and structural capital - on organizational innovation ambidexterity	The quantitative data from 217 small and medium enterprises from the manufacturing sector of Pakistan.	All three dimensions have the potential to affect organizational ambidexterity positively.
4	Gürlek (2020)	The combined effect of intellectual capital on organizational ability to pursue innovation ambidexterity	The quantitative data collected from 462 senior managers of the four- and five-star hotels in Istanbul and Antalya, Turkey	The intellectual capital can help organizations in achieving innovation ambidexterity.

5	Fernández-Pérez de la Lastra, Martín-Alcázar, and Sánchez-Gardey (2020)	The interrelationships between intellectual capital and organizational innovation ambidexterity in the haute-cuisine restaurants sector	Ten semi-structured interviews with the sector experts from haute cuisine restaurants	1. The findings demonstrate with the practical examples that how human capital, social capital, and organizational capital are used individually in the pursuit of innovation ambidexterity in the haute-cuisine restaurants. Human capital is the most essential constituent in these restaurants to pursue ambidexterity. 2. The restaurants build versatile and flexible organizational capital that is a good balance of mechanistic organizational capital and organic organizational capital) that can facilitate both exploration and/or exploitation as required in each situation.

6	Duodu and Rowlinson (2019)	The effect of intellectual capital components on asynchronous pursuit of exploration and exploitation in the specific context of construction sector of Hong Kong	The quantitative data from 135 management personnel from construction contractor firms in Hong Kong	Social capital and organizational capital are directly and linearly instrumental in the asynchronous pursuit of exploration and exploitation in the sector. However, contrary to the hypotheses postulated, human capital is not capable of such a pursuit directly.
7	Mubarik, Naghavi, and Mahmood (2019)	The role of organizational ambidexterity between intellectual capital and competitive advantage	Quantitative data from 223 textile firms from Pakistan	Three components of intellectual capital contribute to organizational ambidexterity positively such that the human capital contributes most while relational and structural capitals follow human capital.
8	Swart, Turner, Van Rossenberg, and Kinnie (2019)	Individual roles and HRM practices that enable organizational ambidexterity at the individual level	Quantitative cross-sectional data from 212 employees and 35 semi-structured interviews from a global professional service firm in the UK	Senior employees use 'integration', 'role expansion' and 'tone setting', whilst employees with specialist customers knowledge play 'gap filling' role to enable ambidexterity. The study found HRM ambidexterity framework that can enable individual roles to facilitate organizational ambidexterity.

9	Diaz-Fernandez, Pasamar-Reyes, and Valle-Cabrera (2017)	Idiosyncratic HRM practices to develop respective type of human capital (generalist vs. specialist) to facilitate respective organizational learning (explorative vs. exploitative) for different units from structural ambidexterity perspective	Quantitative data from 107 Spanish firms	Different types of human capital mediate the relationship between different HRM practices and different types of learning in different organisational units. Specialist human capital mediates the relationship between performance appraisal and exploitative learning in production departments while generalist human capital mediates between training and explorative learning in marketing departments.
10	Lakshman, Dupouët, and Bouzdine-Chameeva (2017)	HRM practices and intellectual capital architecture to foster ambidexterity from structural ambidexterity and contextual ambidexterity perspectives	Exploratory case study in a French MNC	Against Kang and Snell (2009) framework, types or forms of organizational ambidexterity are not mutually exclusive and can coexist. Two types of ambidexterity can complement each other. The study found the coexistence of each pair of typological types of the individual components of intellectual capital (Kang & Snell, 2009) and HRM practices (high-performance work systems and administrative HR systems) for contextual and structural forms of ambidexterity

11	Lin, McDonough, Yang, and Wang (2017)	1. The combined effect of knowledge assets on organisational ambidexterity. 2. The relative influence of human capital than organisational capital in pursuing exploratory and exploitative innovations	The quantitative data from middle and senior managers in two high-tech parks in China.	1. A greater reliance on organisational capital than on human capital facilitates exploitative innovation. 2. Social capital moderates the greater reliance on organisational capital than on human capital in facilitating exploration innovation strategies. 3. A greater amount of human capital than organisational capital is negatively and non-significantly associated with explorative innovation strategies.
12	Fu, Ma, Bosak, and Flood (2016)	The linear impact of each knowledge asset on ambidexterity – synchronous pursuit of exploration and exploitation	The quantitative data from 112 Chinese professional service firms and 93 Irish accounting firms.	1. The impact of human capital on organisational ambidexterity for the Chinese sample was non-significant. However, this impact was significant for other two knowledge assets. 2. The separate impacts of organisational and social capital on organisational ambidexterity were non-significant in the Irish sample.
13	Turner, Swart, Maylor, and Antonacopoulou (2016)	How managerial actions enable project ambidexterity?	Eight project-based case studies in the Information Technology services sector	The study explores managerial actions that enable ambidexterity and explore the complex interaction between different elements of intellectual capital in the pursuit of ambidexterity.

14	Rezende, Torres, Correia, Nicolini, and Bernardes (2016)	The promotion of ambidexterity through intentional deployment of intellectual capital and enabling context in order to develop university lecturers' competencies and thus, to improve students' skills.	A descriptive case study of PACT project implementation in a university in Rio de Janeiro, Brazil. The qualitative data was comprised of documentary and field participative evidences coupled with observations.	The PACT project implementation along with the joint deployment of specialist human capital, cooperative social capital, and organic organizational capital helped creating an enabling context that helped faculty and university to achieve ambidexterity.
15	Prieto-Pastor and Martin-Perez (2015)	HRM, ambidextrous employees, and ambidextrous learning from contextual ambidexterity perspective	The data from 182 Spanish companies	HRM produces ambidextrous employees that in turn pursue ambidexterity
16	Kostopoulos, Bozionelos, and Syrigos (2015)	The effects of each knowledge asset on unit ambidexterity	The quantitative, multisource, and time lagged data from 148 units in 58 Fortune 500 US companies	Human and social capital have positive relationships with unit ambidexterity whilst organisational capital has a negative relationship with unit ambidexterity.

17	Turner, Maylor, and Swart (2015)	Exploring the different mechanisms at operational levels through which project employees use three dimensions of intellectual capital individually or in combinations to pursue project ambidexterity.	Sixteen semi-structured interviews with different types of senior managers managing varieties of technology projects in a global IT-services firm.	Depending upon the need to pursue exploratory and/or exploitative activities, the project managers choose individual or combinative utilization of human capital (generalist vs. specialist), social capital, and organizational capital (organic vs. mechanistic). In addition, project managers use Four combinations of three dimensions of intellectual capital – socialized control (social capital and organizational capital), process customization (human capital and organizational capital), personal network utilization (human capital and social capital), and resource integration (human capital, social capital, and organizational capital) –to pursue project ambidexterity in the firm.

18	Turner et al. (2014)	Explaining the association between project ambidexterity and knowledge strategy in terms of knowledge asset development	A framework from the literature is developed. The qualitative data from a longitudinal case study from 2012 on the telecommunication delivery of the London Olympics is used to illustrate the importance of knowledge assets for ambidexterity and how a knowledge strategy could be formed in the light of the potential need for ambidexterity.	
19	Turner and Lee-Kelley (2013)	Exploration of mechanisms, architectures, and dynamics at operational levels in the pursuit of ambidexterity	A single case study of a project management office in a multinational IT company	There is co-existence and mutual interdependence of elements of intellectual capital and ambidexterity facets in project management contexts.
20	Turner, Maylor, and Swart (2013)	The findings of a thesis regarding if and how project managers manage ambidexterity in their projects.	1. A systematic review of the literature comprising theoretical and empirical studies 2. Two stage empirical investigation (interviewing a group of managers in a global IT service firm, followed by eight case studies)	The knowledge assets that enable ambidexterity are interwoven with each other and two dimensions of project ambidexterity.

21	Kang, Snell, and Swart (2012)	The effects of intellectual capital (generalist human capital, internal social capital, and mechanistic organisational capital) on explorative learning and exploitative learning in law firms' practice groups.	The quantitative data from 167 practice groups in 114 law firms.	Human capital affects exploration marginally and only while organizational capital affects exploitation only. On the other hand, social capital has the potential to affect both exploration and exploitation.
22	Swart and Kinnie (2010)	The interrelationships between human resource management (HRM) and the nature of knowledge assets (human, capital, social capital, and organisational capital) for effective organisational learning (exploratory and exploitative learning)	The case studies of 16 professional service firms	Different combinations of HR practices and knowledge assets can facilitate both types of organisational learning simultaneously.
23	Subramaniam and Youndt (2005)	How various aspects of intellectual capital affect exploratory innovation and/or exploitative innovation?	The quantitative and longitudinal data from the executives of 93 organizations	Organizational capital influences exploitative innovation positively while human capital affects exploratory innovation negatively. However, human capital affects exploratory innovation positively in the presence of social capital. The social capital influences both types of innovation positively.

Table 2: Measurement model results

Constructs	Code	Item wording	S.F.L	S.E	*t*-value [a, b]	α	C.R	ρ_A	AVE [c]	VIF
Human capital						0.87	0.91	0.87	0.66	
	HC1	Our employees are highly skilled at their jobs.	0.78	0.02	31.74					1.90
	HC2	Our employees are widely considered the best in our industry.	0.83	0.02	41.69					2.30
	HC3	Our employees are creative and bright.	0.83	0.02	52.55					2.48
	HC4	Our employees are experts in their particular jobs and functions.	0.78	0.03	28.78					1.78
	HC5	Our employees develop new ideas and knowledge.	0.84	0.02	49.89					2.27
Social Capital						0.89	0.92	0.89	0.69	
	SC1	Our employees are skilled at collaborating with each other to diagnose and solve problems.	0.84	0.02	47.40					2.44
	SC2	Our employees share information and learn from one another.	0.85	0.01	59.07					2.71
	SC3	Our employees interact and exchange ideas with people from different areas of the company	0.83	0.02	43.04					2.25
	SC4	Our employees partner with customers, suppliers, alliance partners, etc., to develop solutions.	0.81	0.02	34.51					2.06
	SC5	Our employees apply knowledge from one area of the company to problems and opportunities that arise in another.	0.83	0.02	41.68					2.26
Organisational Capital						0.84	0.89	0.85	0.68	
	OC1	Our organisation uses patents and licenses as a way to store knowledge.	0.77	0.02	34.24					1.60
	OC2	Much of our organisation's knowledge is contained in manuals, databases, etc.	0.82	0.02	41.94					1.94
	OC3	Our organisation's culture (stories, rituals) contains valuable ideas, ways of doing business, etc.	0.85	0.01	63.87					1.99
	OC4	Our organisation embeds much of its knowledge and information in structures, systems and processes.	0.84	0.02	45.70					2.08

Exploitative learning						0.89	0.92	0.90	0.69	
	Exploit1	We upgraded current knowledge and skills for familiar products and technologies.	0.86	0.02	51.30					2.83
	Exploit2	We invested in enhancing skills in exploiting mature technologies that improve productivity of current operations.	0.88	0.02	57.89					3.14
	Exploit3	We enhanced competencies in searching for solutions to customer problems that are near to existing solutions rather than completely new solutions.	0.70	0.04	15.49					1.53
	Exploit4	We upgraded skills in product development processes in which the firm already possesses significant experience.	0.86	0.01	57.79					2.59
	Exploit5	We strengthened our knowledge and skills for projects that improve the efficiency of existing innovation activities.	0.86	0.02	55.01					2.47
Exploratory learning						0.90	0.93	0.91	0.72	
	Explore1	We acquired knowledge of manufacturing technologies and skills that is entirely new to the firm.	0.83	0.02	43.63					2.79
	Explore2	We learned product development skills and processes (such as product design, prototyping new products, timing of new product introductions, and customising products for local markets) that are entirely new to the industry.	0.86	0.02	51.51					3.06
	Explore3	We acquired entirely new managerial and organisational skills that are important for innovation (such as forecasting technological and customer trends; identifying emerging markets and technologies; coordinating and integrating R&D; marketing, manufacturing, and other functions; and managing the product development process).	0.85	0.02	45.31					2.45
	Explore4	We learned new skills in areas such as funding new technology, staffing R&D functions,	0.87	0.01	64.49					2.77

Explore5	training and development of R&D and engineering personnel for the first time. We strengthened innovation skills in areas where there was no prior experience.	0.83	0.02	46.87		2.16

Note: S.L.F = Standardised factor loadings; S.E = Standard error; [a] Test-statistics are obtained by 500 bootstrap runs; [b] Absolute *t*-values > 1.95 are two-tailed significant at 5%; α = Cronbach's alpha; C.R = Composite reliability; ρA = Dijstra-Henseler's rho; AVE = Average variance extracted; [c] Percentage of variance of item explained by the latent variable.

Table 3: Mean, standard deviations, correlations and discriminant validity results

	Mean	SD	VIF	1	2	3	4	5	6	7	8	9	10
1. Firm size	2.80	2.08	2.51	*1.00*	0.77	*F*	*F*	0.10	0.05	0.22	0.11	0.17	0.13
2. Revenue	4.35	2.98	1.06	.769**	*1.00*	*F*	*F*	0.08	0.05	0.18	0.10	0.18	0.13
3. Ownership type	0.05	0.12	1.05	.194**	0.14**	*F*	*F*	*F*	*F*	*F*	*F*	*F*	*F*
4. Industry type	0.15	0.09	1.08	-0.06	-0.20**	0.14**	*F*	*F*	*F*	*F*	*F*	*F*	*F*
5. Human capital	4.37	1.00	3.22	0.09	0.07	0.03	-0.08	*0.81*	0.88	0.88	0.74	0.67	0.70
6. Social capital	4.39	1.03	2.26	0.03	0.00	0.04	-0.07	0.78**	*0.83*	0.82	0.71	0.61	0.66
7. Organisational capital	4.30	1.09	2.58	.201**	0.16**	0.08	-0.12*	0.76**	0.72**	*0.82*	0.77	0.75	0.75
8. Exploitative learning	4.32	1.06	3.23	.107*	0.09	0.07	-0.14**	0.65**	0.63**	0.67**	*0.83*	0.88	0.80
9. Exploratory learning	4.10	1.12	2.91	.163**	0.17**	0.02	-0.18**	0.60**	0.55**	0.66**	0.79**	*0.85*	0.80
10. Ambidexterity	18.63	8.40	3.11	.131**	0.14**	0.04	-0.19**	0.66**	0.62**	0.69**	0.91**	0.94**	*1.00*

Note: SD: Standard deviation. VIF: Variance inflation factor.
Diagonal and italicised elements are the square roots of the AVE (average variance extracted).
Below the diagonal elements are the correlations between the construct's values.
Above the diagonal elements are the HTMT values.
F: Formative composite construct; HTMT is not meaningful criterion for formative construct.

Table 4: Significant testing results of the structural model path coefficients

Structural path relationships	Path coefficient	SE	*t*-value (bootstrap)	95% BCa Confidence Interval	Effect size (f^2)	Conclusion
Structural Model Results						
Control Variables						
Size → Exploitative learning	$0.00^{n.s}$	0.05	0.08	[-0.09, 0.09]	0.00	
Size → Exploratory learning	$0.00^{n.s}$	0.05	0.07	[-0.10, 0.08]	0.00	
Size → Ambidexterity	$-0.01^{n.s}$	0.05	0.28	[-0.10, 0.07]	0.00	
Revenue → Exploitative learning	$0.00^{n.s}$	0.05	0.03	[-0.09, 0.08]	0.00	
Revenue → Exploratory learning	$0.08^{n.s}$	0.05	1.46	[-0.01, 0.16]	0.00	
Revenue → Ambidexterity	$0.05^{n.s}$	0.05	1.00	[-0.03, 0.13]	0.00	
Ownership type → Exploitative learning	$0.03^{n.s}$	0.04	0.82	[-0.03, 0.10]	0.00	
Ownership type → Exploratory learning	$-0.03^{n.s}$	0.03	0.82	[-0.08, 0.02]	0.00	
Ownership type → Ambidexterity	$0.00^{n.s}$	0.03	0.06	[-0.05, 0.05]	0.00	
Industry type Exploitative learning	$-0.07^{n.s}$	0.04	1.60	[-0.13, 0.02]	0.01	
Industry type → Exploratory learning	-0.09^{*}	0.05	1.93	[-0.15, 0.01]	0.01	
Industry type → Ambidexterity	-0.10^{*}	0.05	2.13	[-0.09, 0.09]	0.02	
Direct Effect						
Human capital → Social capital	0.77^{***}	0.02	32.80	[0.73, 0.81]	1.50	H1: Accepted
Human capital → Organisational capital	0.50^{***}	0.06	8.86	[0.40, 0.58]	0.26	H2: Accepted
Social capital → Organisational capital	0.33^{***}	0.06	5.30	[0.23, 0.44]	0.12	H3: Accepted
Social capital → Exploitative learning	0.32^{***}	0.07	4.55	[0.21, 0.44]	0.10	H4: Accepted
Social capital → Exploratory learning	0.16^{*}	0.07	2.36	[0.05, 0.27]	0.03	H5: Accepted
Social capital → Ambidexterity	0.27^{***}	0.06	4.34	[0.17, 0.37]	0.08	H6: Accepted
Organisational capital → Exploitative learning	0.44^{***}	0.07	6.11	[0.31, 0.55]	0.18	H7 Accepted
Organisational capital → Exploratory learning	0.55^{***}	0.06	9.01	[0.44, 0.64]	0.26	H8: Accepted
Organisational capital → Ambidexterity	0.49^{***}	0.06	8.39	[0.39, 0.58]	0.24	H9: Accepted

*Note:*SE: Standard error.

t (0.05, 4999) = 1.645; *t* (0.01, 4999) = 2.327; *t* (0.001, 4999) = 3.092.

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$, based on *t* (4999), one-tailed test.

BCa = Bias corrected confidence interval. Bootstrapping based on *n* = 5000 subsamples.

The values of f^2; 0.02, 0.15,0.35 for weak, moderate, strong effects.

Table 5: Determination Coefficients (R^2) and predictive relevance (Q^2) of endogenous (omission distance=7)

Goodness of model fit				
SRMR Composite Model = 0.05				
Structural model fit			***Predictive relevance of model fit***	
Endogenous variable	**R^2 values**	**Threshold**	**Q^2 values**	**Threshold**
Social capital	0.60	Moderate	0.39	>0
Organisational capital	0.62	Moderate	0.39	>0
Exploitative learning	0.50	Moderate	0.32	>0
Explorative learning	0.45	Weak	0.30	>0
Ambidexterity	0.51	Moderate	0.49	>0

Note: R^2 = Determination coefficients; Q^2= Predictive relevance of endogenous (omission distance=7).
Threshold for R^2 value $\geq$ 0.25 (weak); $\geq$ 0.50 (moderate); $\geq$ 0.75 (substantial).
Threshold for Q^2 value $>$ 0 indicate predictive relevance.

Table 6: Mediation analysis results (by bootstrapping approach)

Effect	Direct effect	Indirect effect	Total effect	VAF	Interpretation	Conclusion
Social capital → Organisational capital → Exploitative learning	0.32***	0.15***	0.47***	31.91%	Partial mediation	H10: Accepted
Social capital → Organisational capital → Exploratory learning	0.16**	0.18***	0.34***	52.94%	Partial mediation	H11: Accepted
Social capital → Organisational capital → Ambidexterity	0.27***	0.17***	0.44***	38.64%	Partial mediation	H12: Accepted

Note: The hypotheses (H10, H11, & H12) regarding the mediating effects concern the two path relationships *a* and *b*, whereby the product of path *a* and *b* represents the mediating effect (i.e. indirect effect); the total effect is the sum of the direct and indirect effects; this study used a bootstrapping approach (Hair et al., 2017) with 5000 subsamples, 424 bootstrap cases and no sign changes to determine the significance of the path coefficients.

t (0.05, 4999) = 1.645; *t* (0.01, 4999) = 2.327; *t* (0.001, 4999) = 3.092.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$, based on *t* (4999), one-tailed test.

VAF = variance accounted for. VAF>80% indicates full mediation, 20%≤VAF≥80% shows partial mediation while VAF<20% assumes no mediation.

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Appendix A

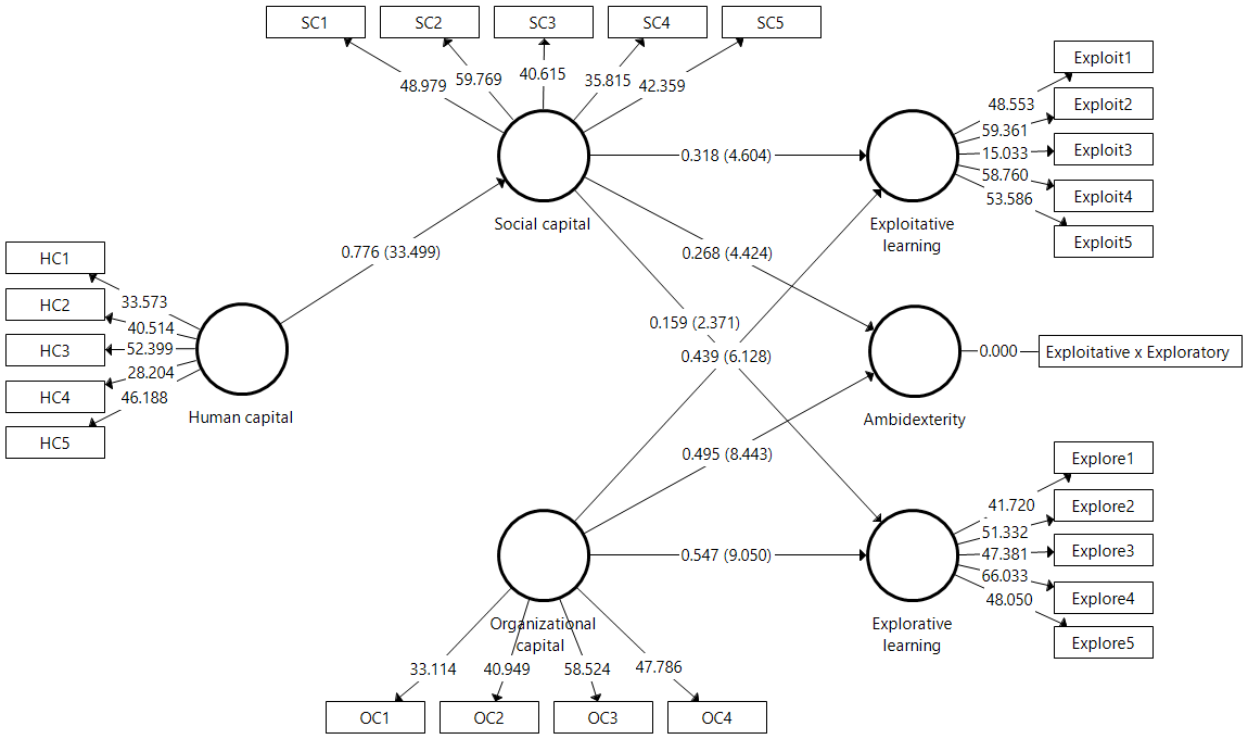

Fig.1 Structural model results without mediation

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Muhammad Shujahat is a PhD Candidate at the Knowledge Management & E-Learning Lab, Faculty of Education, The University of Hong Kong. The current theme of his research studies is to explore and examine the context-informed and conducive managerial practices and contexts that can help shape and manage the knowledge behaviours and the productivity of knowledge workers. On this theme, he has conducted and published practice-driven research in several renowned journals, including *Journal of Business Research* and *Journal of Knowledge Management*. His research has been referred in the *European Union* report on digital skills and stood out as ESI and the publishers' Highly Cited Article.

Zulfiqar Ali is a lecture in the Division of Business and Hospitality Management, College of Professional and Continuing Education, The Hong Kong Polytechnic University, Kowloon, Hong Kong. Earlier he was postdoctoral fellow at City University of Hong Kong. His research areas include innovation and capability development in SMEs, technology and innovation management, interoperability and agile SMEs, creativity, design thinking and innovation in higher education. He has also developed a design thinking model, called SNIPE. He has published in peer-reviewed journals including, *Sustainability*, *Journal of Manufacturing Technology Management and International journal of environmental research and public health.*

Aino Kianto, D.Sc. is a Professor in Knowledge Management at the LUT School of Business and Management, LUT University, Finland. Her research focuses on knowledge management, intellectual capital, creativity, innovation and organizational renewal. Her research on these topics has been published widely, for example, in *Human Resource Management Journal*, *Journal of Knowledge Management, R&D Management*, *Journal of Business Research*, and *Accounting, Auditing and Accountability Journal*. She holds an editorial board position in five academic journals.

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Nick Bontis is an Associate Professor and Chair of Strategy at the DeGroote School of Business, McMaster University. He received his PhD from the Ivey Business School, Western University. His doctoral dissertation is recognized as the first thesis to integrate the fields of intellectual capital, organizational learning, and knowledge management, and was the number one selling thesis in Canada. He was recognized as the first McMaster professor to win Outstanding Teacher of the Year and Faculty Researcher of the Year simultaneously. He is a 3M National Teaching Fellow, an exclusive honour only bestowed upon the top university professors in Canada. Dr. Bontis is recognized the world over as a leading professional speaker and consultant in the field of knowledge management and intellectual capital.