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INTELLECTUAL DYNAMICS: A FUTURE FOR DYNAMIC CAPABILITIES AND INTELLECTUAL CAPITAL

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ABSTRACT

Dynamic business environment needs easier and faster scientific research approach for its growth and development. Therefore, this paper explores the evolutionary mechanism of dynamic capabilities and intellectual capital by investigating how these theories convergence and reveal integrability towards innovativeness by a systematic literature review of 223 articles from 2000 till 2021. The findings reveal that the dynamic capabilities convergence in many aspects with intellectual capital dimensions becoming irreplaceable assets to support firms acquire, renew, and reconfigure resources to conquer its own development puzzles and dynamic knowledge ecosystems during its evolution. The intellectual capital is an important resource for dynamic capabilities and vice-versa. From a framework proposed the paper enriches understandings and simplification of the literature and can help to enhance innovativeness in practice.

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INTRODUCTION

The extant literature about dynamic capabilities (DC) and intellectual capital (IC) brings more questions than answers about how these theories can support business in practice and how researchers can contribute to clarify the relationships between capabilities and resources through knowing markets and customers, organizational processes and structures, relationships and innovations or firms' overall performance. This means that a holistic model of how these theories influence firms' evolution are under-explored (Ramadan, Dahiyat, Bontis & Al-Dalalmeh, 2017; Ngah, Tai & Bontis, 2016; Wang, Sharma & Cao, 2016; Kianto, Ritala, Spender & Vanhala, 2014) and demands more simplification to avoid replicabilities. Being aware of today's business environment agility and interdisciplinary demands studies for market and business evolution (Buyalskaya et al., 2021), we pursue facilitate for practitioners the understanding about theories usage. The perspectives of IC and DC, by the resource-based view (Barney, 1991), relational-based view (Dyer & Singh, 1998) and the knowledge-based view (Tamer Cavusgil, Calantone & Zhao, 2003), bring some dimensions that dominate the literature but not totally clarify how they act together to influence firms operationally, financially, or strategically. Dynamic capability involves management and technical perspective (Teece, 1997; 2007).

Intellectual capital consists of assets, such as human capital, structure capital and social capital (Stewart, 1997; Bontis, 1998). The literature also shows up dynamic capabilities has a positive effect on structural and social capitals (Subramaniam & Youndt, 2005; Wang et al., 2016) and has a significant effect on firms' performance, innovation or increase market share (Yesil & Dogan, 2019, JayaniRajapathirana & Hui, 2018; Shin, He & Kim, 2016). The fact is, there is an influence from DC in IC and vice-versa suggesting that firms need to take a longer-term perspective to survive (Huang & Huang, 2020). Therefore, to address the business challenges that accompany positive trends, such as the search for genuinely unifying frameworks and associated best practices that can be employed in response to better firms' performance (Buyalskaya, Gallo & Camerer, 2021), this study opens the door for a new way of studying and understanding DC and IC. The objective of this paper is to provide a systematic review and analysis of the extant literatures in the Dynamic Capabilities and Intellectual Capital which has been developed for more than 20 years, to better clarify the perspectives of the concepts and address how they converge to streamline questions raised in prior research and enhance the applicability for practitioners. In so doing, we hope to maintain the legitimacy, and highlight the important role of 'intellectual dynamics', that is the name used to for DC and IC integrability adopted in this study. Moreover, based on the review, we propose a theoretical framework to summarize important convergency between the theories, to provide theoretical implications for future research to

explore the influence mechanisms of innovativeness, and to offer some important implications in practices. We will review and analyze the dynamic capabilities and intellectual capital literatures in the following four sections. In the first section, we will discuss the basic concepts and real connotations of IC and DC. Specifically, through sorting out and integrating the perspectives views of different researchers. We intend to propose a comprehensive and less controversial definition to better cover the fundamental characteristics of these concepts. In the second section, based on the various research results, we attempt to respond to some gaps between the DC and IC theory and practice. Despite there is inconsistency between the theory and practice, various scholars have taken invaluable efforts to examine the theory in different cases and contexts and provided the fundamental consistency in their study findings to demonstrate the validity of DC and IC. We direct focus our review indicating that the 'intellectual dynamics' might have predictive validity, and provides important value in guiding innovativeness, because numerous scholars have made much progress, and showed that there is a strong influence of DC in IC and vice versa. We integrate DC and IC into a single model and this approach may well be closer of the complexity of firm's relationships with their business environment (Huang & Huang, 2020; Ramadan *et al.*, 2017; Fainshmidt, Pezeshkan, Lance Frazier & Markowski, 2016; Kianto *et al.*, 2014; Tamer *et al.*, 2003). In the third section, we summarize the perspectives and convergency of the theories through classifying the research findings, categorizing new perspectives found in the literature demonstrating some research results and provide implications to guide practice and theory development. In the last section, we propose new insights for the future research and provide implications to guide DC and IC integrability development and practice.

IDENTIFY, RESEARCH AND COLLECT IDEA

Since we need to trace the origin of the basic connotations of the dynamic capabilities (Teece, 1997) and Intellectual Capital (Stewart, 1997) we conduct a literature review of these theories since they were developed more than twenty years ago. Due to that there are too many articles being published in the past two decades, we have selected only the articles published in the SSCI journals for the sake of choosing high quality research articles. We mainly searched the target articles from the database of Web of Science. At first, we used the key search words of "dynamic capabilit*" AND "Intellectual Capital" OR "dynamic capabilit*" AND "Human Capital" OR "dynamic capabilit*" AND "Structural Capital" or "dynamic capabilit*" AND "Relational Capital" OR "dynamic capabilit*" AND "Social Capital" without any time definition (until April 2021, when we collected data).

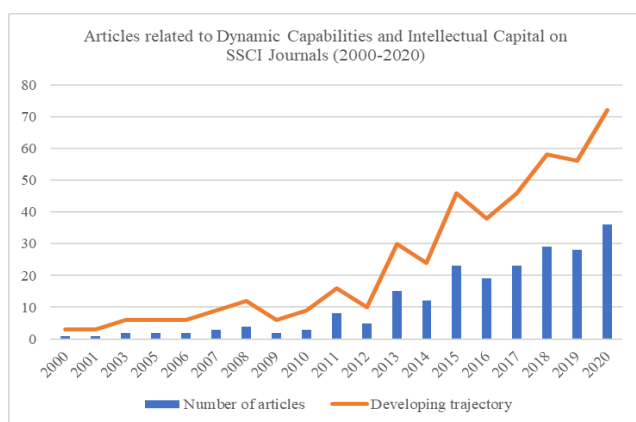


Figure 1. The distribution of dynamic capabilities and intellectual capital articles according to the timeline

The quotation marks served to define the research object; and the application of the asterisk (*) to follow the fundamentals of research based on Boolean algebra. We identified 395 relevant articles. To filter the results, excluding the publications that fall outside the scope of this work, only the articles that were indexed belonging to the

categories "Management", "Business", "Economics", "Business, Finance", "Operations Research & Management Science" from Web of Science TM (Web of Science Categories). Then, we checked the titles, abstracts, and keywords for further screening, and excluded those articles that did not take the constructs as the primary discussion. As a result, 223 articles were qualified as the database for our review. The distribution of the articles according to the timeline is shown in Fig. 1. From it, we see that these research fields have begun to gain its popularity since 2013, with the articles published in SSCI journals beginning to reach more than 10 pieces every year. And the number of related articles has peaked at 36 in 2020. The developing trajectory of the published articles also indicates the upward trend of discussion and development of these theories.

In general, we found that, like other management theories, the research combination of dynamic capabilities and intellectual capital has evolved from more qualitative in early days to more empirical in recent years. The research content has also expanded for human capital embodying dynamic capabilities through structural capital, and social capital driving relational capabilities for sake of developing extensive exploration of business models, products, strategies, internal conditions, and external conditions of firms. In addition, dynamic capabilities leveraging intellectual capital in the development of emerging technologies, including social capital enhancing innovativeness and performance, and new social and technological scenarios such as sharing economy, have been increasingly investigated in the more recent research on innovation performance. This clearly show that more researchers have noticed the relevance of dynamic capabilities and intellectual capital taking their research efforts in addressing these directions.

BRIEF INTRODUCTION OF DYNAMIC CAPABILITIES AND INTELLECTUAL CAPITAL

Intellectual Capital is a multi-dimensional concept of the assets of knowledge, experience, and capabilities to create value (Campbell & Rahman, 2010; Dumay, 2016). Researchers generally agree that IC contributes as a non-physical and non-monetary resource, to creating value and extracting value for organizations through knowledge. Knowledge is not only kept by individuals, but it is also stored by the enterprise database, business processes, systems, and relationships (Youndt & Snell, 2004; Allameh, 2018). IC has gained considerable momentum in the literature over recent decades since knowledge functions as a critical value-creating resource for companies. IC is "the possession of the knowledge, applied experience, organizational technology, customer relationships and professional skills that provide a company with a competitive edge in the market (Edvinsson, 1997; Serenko & Bontis, 2017). Considerable efforts have been devoted to comprehending and conceptualize IC which resulted in several models (e.g., Edvinsson, 1997; Roos & Roos, 1997; Stewart, 1997; Bontis, 1998; Subramaniam & Youndt, 2005). The most common and standard conceptualization divides IC into three dimensions, i.e., human capital, structural capital, and relational capital, which refer to knowledge embedded in people; organizational structures, processes, and systems; and relationships and networks respectively (Kianto, Sáenz & Aramburu, 2017). On the other hand, capability literature draws a distinction between operating and DC (Helfat & Peteraf, 2003). Operating capabilities are usually routine-based and enact the day-to-day operations of the firm – i.e., business as usual (Winter, 2003). In contrast, DC are heuristics-based and "create, extend or modify," "integrate, build and reconfigure" (Teece, Pisano & Shuen, 1997) and/or "sense, seize and transform" (Teece, 2007) the firm's operating capabilities. A key finding of capability research is that both types of capability are required – operating capabilities are for stability while DC are for change (Newey & Zahra, 2009; Martinelli, Tagliazucchi & Marchi, 2018). Helfat, *et al.* (2007) brought new perspectives for DC introducing a well structure approach for relational capabilities using alliance, fusions, and acquisitions into dynamic contexts for value creation.

Although both literatures have significantly developed the research paradigm of IC and DC are still relatively new, and some scholars

have related them to the innovation topic, learning practices, knowledge management, firm performance, and others (Alves, Cepeda-Carrion, Ortega-Gutierrez & Edvardsson, 2020; Ahmed, Guozhu, Mubarik, Khan & Khan, 2019; Chatzoglou & Chatzoudes, 2018; Jardon, 2018). However, we find few works have centered on IC and explore points of convergence with DC to streamline theory and avoid replicabilities. Thus, the next section provides a parallel model of perspectives about DC and IC to summarize their definitions, foundations, and similarities.

PERSPECTIVE OF DYNAMIC CAPABILITIES AND INTELLECTUAL CAPITAL DEFINITIONS

At first, we identify what exactly the term "dynamic capabilities" and "intellectual capital" stands for. In this paper we have tried to make a more accurate and comprehensive definition by systematically integrating ideas from different scholars. According to our summary and analysis of all the related articles, the extant definitions can be categorized from three perspectives for each research field. Table 1 shows the relatively recent nature of theoretical foundations of prior work from the articles selected. Little is known about intertwining of DC dimensions and IC prior to this period and there is no study of similarities or replicabilities over this extended period. We found studies related antecedents and consequences of IC showing potential absorptive capacity does not intervene in the relationship between the components of IC and those of business performance (Allameh, 2018). Therefore, this paper comes up to innovate through simplifying contents to overcome replicabilities between theories making easier their comprehension and applicability, mainly for practitioners. The first perspective to define dynamic capabilities and intellectual capital is based on main specific types of capabilities pursued by human capital which comprise creative and problem-solving capability, leadership, entrepreneurial and managerial skills, or technical capabilities (Mitchell, Boyle & Nicholas, 2020; Helfat *et al.*, 2007; Youndt & Snell, 2004). The interdependence of these first perspective between human capital and capabilities is under the essence of business existence, it means, without human capital there is no capabilities to be identified. To build new activity system for any kind of business in which new partners are configured in an unprecedented way compared to existing business models (Snihur, Thomas & Burgelman, 2018) the human capital predicts the level of capabilities or potential level of development the business will have (Colombeli, 2015). This disrupts established models or redefines the meaning of value creation and acquisition of business in general.

Regarding this first perspective, it is only a more detailed and specific description of where capabilities reside. As Chatterji & Patro (2014) indicate that people 'acqui-hiring' as one example of asset orchestration is an important dynamic capability embodied in top management and implemented in the management of human capital. And Colombelli (2015) believes that human capital and firm characteristics are important determinants of their rapid growth. The second perspective is based on social capital (Nahapiet & Ghoshal, 1998; Youndt & Snell, 2004) and relational capabilities (Dyer & Singh's, 1998; Helfat *et al.*, 2007) on the evolving business process. It emphasizes that relational view is not merely an inevitable interaction among people but a complete and progressive process for value cocreation, business model development, knowledge transferring and innovativeness (Sanchez-Famoso, Maseda & Iturralde, 2017; Chirico & Salvato, 2016; Ortiz, Donate & Guadamillas, 2017; Rodrigo-Alarcón, García-Villaverde, Ruiz-Ortega & Parra-Requena, 2018). The central view of this perspective comprises both the network and the assets that may be mobilized through that network (Yiu & Lau, 2008; Huynh, 2016). The positive effect of human capital on innovativeness is moderated by intensity in collaboration, being human capital enhanced by social capital (Carmona-Lavado, Cuevas-Rodriguez & Cabello-Medina, 2013; GomezeljOmerzel & SmolčićJurdana, 2016). Also, the effect of social capital on innovativeness is mediated by human capital and moderated by intensity in collaboration which is interpreted in the literature as an innovative and dynamic capability (Martinelli, Tagliacuzzi & Marchi, 2018; Yesil & Dogan, 2019).

The third perspective of the definition of intellectual capital and dynamic capabilities is based on its power of structural process generation as a way of making tangible the effect of powerful capabilities through human capital and relational capabilities among the structure social capital exist. The definitions generated from this perspective are usually scattered and cannot be systematically categorized or integrated, because they are identified as those technologies, methodologies and processes which enable the organization to function and each of them have their own way of doing so (Bontis, 1998; Youndt *et al.*, 2004). However, comparatively both perspectives are similar in defining the routines, coordination, or integration to achieve standards of practice and learning to renew, reconfigure and develop how the company is preparing itself for the future (Teece, 2007; Helfat *et al.*, 2007).

The perspectives of definitions based on the human and capabilities, social and relational view or organizational structure and processes are subdivisions used by many scholars to initiate an in-depth discussion according to their specific research objectives and processes. Nevertheless, no matter how specific objectives change, the perspectives of definitions have all retained these fundamentals. So, we suggest that these three perspectives of definition can be integrated in the future research on IC and DC to streamline the process of understanding from practitioners. However, we believe that the main reason that causes a potential separation in the concepts from researchers lies in the first perspective based on its effects. For example, human capital may not necessarily have enough technical or evolutionary capacity to earn a living by creating, expanding, or modifying the business resource base. This would easily cause confusion. And we can see that a huge definition of DC and IC based on these perspectives of effects are too replicable almost as a "mantra". Although the call for expanding the concept of DC and IC has always existed (Kianto, Ritala, Vanhala & Hussinki, 2018, Helfat *et al.*, 2007), and it does not mean that this expanding can be divorced from the fundamental basis of the theory originally proposed. Any expansion of a basic concept is not easy and must be accomplished through a strict process of logical reasoning, induction, and verification (Si & Chen, 2020). However, we believe that the accuracy, applicability for practitioners and simplification of definitions on its effect are still open for discussion following news perspectives for more adherence of social sciences in business environment. In sum, despite the similarities caused by the perspectives, we believe that the integration of these three perspectives define a new vision that we call "intellectual dynamics" and which may have the consistency of containing many or most of the basic characteristics of dynamic capabilities and intellectual capital fully integrated. Therefore, we highlight that defining intellectual dynamics based on its indispensable characteristics and process would be the most accurate way to grasp the real connotations and implications of the DC and IC.

Gaps between Dynamic Capabilities and Intellectual Capital theory and practice: Beyond the overlapping of definitions, dynamic capabilities and intellectual capital theories are also mired in some disputes among scholars and practitioners. The first dispute is about whether dynamic capabilities is meaningful to firms. For this issue, a common question is how and when companies should identify their dynamic capabilities for their resource's configuration (Helfat *et al.*, 2007) to innovate, to manage strategies (Peteraf & Bergen, 2003) or to create value (Sirmon, Hitt & Ireland, 2007). Although the advocates of dynamic capabilities argue that DC is important for innovative strategy for firms, which can bring incredible growth and success (Christensen *et al.*, 2002). For practitioners what is important to identify would be when the human capital interfere in the quality of dynamic capabilities or in the development of them for business performance. Or whether the extent of employees' engagement (human capital) in knowledge sharing behavior with their peers and their managers' leadership (social capital) support exert a positive impact on organizations' knowledge management success to develop and create new dynamic capabilities (Muhammed & Zaim, 2020) to sustain competitive advantages. For example, predicting the disruptiveness of an innovation is important for firms, so that they

can avoid the harmful consequences of ignoring a disruptive innovation. If managers (human capital) can identify disruptive innovations before that some technologies disrupt the market (sensing capabilities [Teece, 2007]), they can take action to turn potential market disruption into new opportunities, building appropriate organizational structure (structural capital) – or at least, prevent organizational failure (Si & Chen, 2020).

knowledge resources to enhance innovativeness through DC and IC. Considerable emphasis is put on approaches such as networks (i.e., structural social capital [Zaragoza-Saez *et al.*, 2016]) to facilitate sourcing diverse strands of knowledge as well as put on trusting relationships (i.e., social capital [Pham *et al.*, 2019]) tied to interaction quality as a complement that encourage the sharing and assimilation of knowledge (Sheng & Hartmann, 2019).

Table 1. Perspective about Dynamic Capabilities and Intellectual Capital

INTELLECTUAL CAPITAL	Authors Reference
HUMAN CAPITAL Include psychological characteristics regarding how individuals may perform in given situations, such as in a team or under stress. Human capital refers to the intelligence of organizational members. It is a combination of genetic inheritance, education, experience and attitudes about life and business.	Edvinsson (1997); Edvinsson and Malone (1997); Saint-Onge (1996); Brooking (1996), Stewart (1997); Bontis (1998); Roos <i>et al.</i> (1998); Sullivan (1999); Youndt and Snell (2004); Marr (2006); Bueno <i>et al.</i> (2011).
SOCIAL CAPITAL is an actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit. It may be mobilized through that network. It includes relationships with customers, suppliers, investors, creditors, or R&D partners.	Brooking (1996); Nahapiet and Ghoshal (1998); Meritum Project (2002); Youndt and Snell (2004); Marr (2006); Bueno <i>et al.</i> (2011)
STRUCTURAL CAPITAL refers to infrastructure assets and those technologies, methodologies and processes which enable the organization to function. Examples include corporate culture, methodologies for assessing risk, methods of managing a sales force, financial structure, databases of information on the market or customers, communications systems such as e-mail and teleconferencing systems.	Edvinsson (1997); Edvinsson and Malone (1997); Brooking (1996), Sveiby (1997); Bontis (1998); Roos <i>et al.</i> (1998); Youndt <i>et al.</i> (2004); Marr (2006); Bueno <i>et al.</i> (2011)
DYNAMIC CAPABILITIES	Authors Reference
CAPABILITIES CRITERIA 1. Technical capacity indicates the effectiveness with which a capacity performs its intended function, influenced by quality and cost (internal measure of the performance of dynamic capacity) and by the market and competition demand. 2. Evolutionary capacity refers to how well a dynamic capacity allows an organization to earn a living by creating, expanding, or modifying its resource base.	Nelson and Winter, (1982); Collis, (1994); Winter, (2003); Wang and Ahmed (2007); Andreeva and Chaika (2006); Wang and Ahmed (2007); Helfat <i>et al.</i> (2007).
RELATIONAL CAPABILITIES is an intentional process with a greater likelihood of success if specific structural decisions are made in the organization and if there is support for resource creation in senior management.	Cohen and Levinthal (1990); Hamel (1991); Balakrishnan and Koza (1993); Gulati (1995); Dyer (1996); Powell <i>et al.</i> (1996); Dyer and Singh's (1998); Karim and Mitchell (2000); Garrette and Mitchell (2000); Dussauge <i>et al.</i> (2001); Helfat <i>et al.</i> (2007).
ORGANIZATIONAL AND MANAGERIAL PROCESSES encompass three categories: 1. Coordination and Integration (static): how effectively and efficiently the company is internally, or what can be referred to as its routines, coordination or integration are achieved or standards of current practice and learning. 2. Learning (dynamic): it must build the organizational knowledge generated by the activity that resides in new processes that represent successful solutions. 3. Reconfiguration and Transformation (Transformational): ability to perceive the need to reconfigure the organization's asset structure to support the internal and external transformation and to adopt best practices.	Bower, 1970; Burgelman, 1983; Barney, 1991; Szulanski, 1996; Barney, 1997; Teece <i>et al.</i> , 1997; Brown and Eisenhardt, 1998; Dosi, Nelson, and Winter, 2000; Zollo and Winter's, 2002; Siggelkow, 2002; Maritan and Brush, 2003; Peteraf, 2005; Gilbert, 2005; Dosi, Faillo e Marengo, 2008; Teece, 2007, Helfat <i>et al.</i> , 2007

Practitioners should also understand the relevance of these theories in identifying appropriate intellectual capital and capabilities threat in advance so that they can develop and implement timely strategies (Al-Jinini, Dahiyat & Bontis, 2019). Yet, many scholars no doubt whether the dynamic capabilities and intellectual capital can be integrated in various situations since they are mainly based on analyzing the post hoc empirical evidence of successful cases in their early developments (Ortiz, Donate & Guadamillas, 2017; Rodrigo-Alarcón *et al.*, 2017; Martinelli, Tagliacuzzi & Marchi, 2018). Other scholars focus on the predictive effects of characteristics or relevant influencing factors on DC and IC play the role as indicators of potential innovations (Sanchez-Famoso, Maseda & Iturralde, 2017). Other scholars have studied the mechanisms and processes of DC and IC exploring the three perspectives integrated (see Table 2 for more findings details). For example, identifies the mediator role of social networking integration in the dynamic capability-organizational performance link (Pham, Tran, Thipwong & Huang, 2019; Martinelli, Tagliacuzzi & Marchi, 2018) or analyze the practices' possession of key dynamic capabilities including the heterogeneity of their human capital, their internal development routines, and their alliances with complementary service providers to survive (Fu *et al.*, 2017; Døving & Gooderham, 2008).

AN INTEGRATIVE PERSPECTIVE ABOUT DYNAMIC CAPABILITIES AND INTELLECTUAL CAPITAL

To further understand the integrability of DC and IC, it is major to uncover what factors can influence this connection among the perspectives. First one is the knowledge perspectives that some studies search on how firms can structure and procedurally manage

Such studies seek out organizational capabilities (DC) that improve transfer of knowledge through firm resources (human, structural or social) available for innovativeness, value creation or higher performance (Beattie & Smith, 2013; Teece, 2014; Jin, Hopkins & Wittmer, 2010). We position the integrability of human, structural and social capital with dynamic capabilities based on the overlapping perspectives found in the literature, previously discussed, and take the view that firms can enhance their dynamic knowledge ecosystem to improve explorative and exploitative innovativeness. In addition, DC theoretical foundations argues that highly qualified employees tend to show a greater ability to sense changes and monitor environmental variables, enabling firms to achieve sustainable advantages (Nijssen & Paauwe, 2012; Barrales-Molina, Montes & Gutierrez, 2015). It suggests human capital as a major factor explaining DC' effectiveness and human resource development programs are critical for improving firm competence (Kok & Lighthart, 2014). Additionally, managers trigger the change of routines in different types of product development based on their environmental perceptions. Thus, highly capable managers, who better understand changes in the business environment, can improve an organization's teamwork and efficiency across several channels (Fu, Flood, Bosak, Morris & O'Regan, 2013; Aslam, Blome, Roscoe, & Azhar, 2018).

Studies regarding DC also suggest assessing the nature of human capital to understand how competitive advantage is created in firms that are used to responding to constantly changing contexts, which improves firms' competitiveness and foster DC (Lee *et al.* 2018). In this vein, our understand is that human capital is highly impact in different dynamics and good interpersonal relationships perform a

'boundary-spanning' function that promotes collaboration across channels and departments, improving the ability of organizational integration (Song, Shi & Song, 2019; Hohenstein, Feisel & Hartmann, 2014). So, social capital can encourage firms to share both technological and market information and sustain stable cooperation, responding well to environmental dynamism (Shou, Hu & Xu, 2018; Hsu & Fang, 2009). Hence, it stimulates knowledge-sharing, and integrates individuals. The improvement of organizational learning ability is helpful in the cultivation of integration capability which becomes a strong DC (Gonzalez & Melo 2017; Kianto *et al.*, 2018).

of organizational capital to predict was much higher than other IC dimensions. Social capital is sometimes also called relational capital. It could be defined as embedded interactional knowledge, which specifies the nature and level of interaction among its members (Ahmed *et al.*, 2019). The primary function of social capital is enabling the gathering and distribution of knowledge across an organization. It also allows interactions with other communities and institutions (Ortiz *et al.* 2018). The relationships maintained by actors involved in an ecosystem are more valuable than the actors themselves.

Table 2. Some evidence on empirical research about dynamic capabilities and intellectual capital integrability

Perspectives	Main point
Intellectual Capital on Digital Dynamics	IC, from a digital perspective, should address the development of approaches, strategies, technologies, and infrastructures to acquire, store, and manage all the data that is continuously created inside, outside, and around the organization – the entire ecosystem (Secundo <i>et al.</i> , 2017). Human and artificial intellectual capital is equally crucial for companies. Growth of the level of automatization will lead to a slight extension of the value of Artificial Intelligence (AI), therefore IC have approximately equal strong positive (stimulating its growth) influence on a population's quality of life (Popkova, 2019). Additionally, there is a great need for the proper financial provision of intellectual capital in the era of the information society, the knowledge society, and the knowledge economy that inherit each other to foster new dynamic capabilities to overcome the challenges imposed by AI (Bakumov, 2018).
Human Capital embodying Dynamic Capabilities through Structural capital	Human Capital appears as a central asset managing capabilities, technologies, and strategies. Findings suggest that heterogeneity of human capital provide key DC which have distinct impacts on the scope of organizations (Döving and Gooderham, 2008). It means that, if managers structure their organizational control systems appropriately for developing capabilities, these systems can lead to reduced internal uncertainty regarding human, structural, and relational capital (Herremans <i>et al.</i> , 2011). Hence, the nature and effect of resources employed in the development of capabilities vary greatly based on human capital existent and their capabilities to create appropriate structural capital (McKelvie and Davidsson, 2009). In sum, IC maturity can also be measured through the development and deployment of DC (Shang and Lin, 2010).
Social Capital driving Capabilities	Firms with a higher capability to recognize the value of the knowledge embedded in their inter-organizational networks will be more likely to design better strategies to acquire and integrate such knowledge into their current knowledge bases for either present or future use (Ortiz, Donate & Guadamillas, 2017; Rodrigo-Alarcón <i>et al.</i> , 2017). Three dimensions of social capital, namely, structural, cognitive, and relational capital, influence DC of many businesses, especially in family firms (Sanchez-Famoso <i>et al.</i> , 2017; Wang, 2016; Chirico and Salvato, 2016). Social interaction and network ties dimensions of social capital are indeed associated with greater knowledge acquisition (Kianto <i>et al.</i> , 2018). Knowledge acquisition also plays a mediating role between social capital and knowledge exploitation to enhance new capabilities. (Yli-Renko <i>et al.</i> , 2001).
Dynamic Capabilities leveraging Intellectual Capital	Investment in human capital development and capability development improve firm performance (Sproul <i>et al.</i> , 2019). Contributions of each category of DCs (reconfiguration, leveraging, sensing, and interpreting, learning and knowledge integration) and social capital to entrepreneurs' resilience changes according to the temporal phase during organizational trajectories (Martinelli, Tagliacucchi & Marchi, 2018). There is a positive and significant influence of intra-industry board capabilities connections in firm performance, particularly when they are established among outsiders (Blanco-Alcantara <i>et al.</i> , 2019). IC is a significant determinant of firm performance through DC (Kaawaase <i>et al.</i> , 2020)
Social Capital enhancing Performance	Exploration and exploitation capabilities encourage the firm's development of a pioneer orientation (Garcia-Villaverde <i>et al.</i> , 2019) and are stronger when supported by an appropriate inter-firm and intra-firm social capital (Lin <i>et al.</i> , 2020). The moderating effects of social media use level on the relationships between co-creation mechanism and outcomes are largely supported (Zhang <i>et al.</i> , 2020). And firms with more advanced abilities to identify and assess the value of external knowledge will be likely to develop optimal deliberated strategies to effectively acquire such knowledge from its network partners (Ortiz, Donate & Guadamillas, 2018).
Innovativeness through Intellectual Capital	Organizational learning practices contribute to innovation performance on their own and in combination with the tested human-based IC dimensions (Cabrilo and Dahms, 2020). Findings about knowledge sharing having a positive effect on IC dimensions were found and IC dimensions, which in turn, leading to innovation, as well (Allameh, 2018). IC partially mediates the relationships between organizational capabilities and organizational performance to innovation (Huang and Huang, 2020; Al-Jinini <i>et al.</i> , 2019).

Note. The word trajectories in this study refers to the speed of improvement, and the expected improvement over time. For firm's perspective, almost all firms have a key performance trajectory.

Firm's DC are also generated inside the organization that they change according to different firms and their trajectories (Rajaguru & Matanda, 2019; Gonzalez & Melo, 2017;). The internal integration can reorganize and decentralized ideas, knowledge, and information among cross-functional departments and enhance an organization's flexibility, thus helping to manage a wider assortment of innovativeness and adapt to a changing external environment (Song, Shi & Song, 2019). In parallel, IC theoretical foundations present the capability of human, structural and social capital to have a potential source of competitiveness and ambidexterity (Mubarik, Naghavi & Mahmood, 2019). All the dimensions of IC can improve innovativeness. The possession of an appropriate level of prior knowledge enhances the organizational capability to apply knowledge, both prior and pertinent, which paves the way for creativity. In addition, according to Soo, Tian, Teo & Cordery (2017), human capital has a direct relationship to the firm's capability to absorb and exploit outside knowledge. Structural capital not only establishes the system and mechanisms of knowledge acquisition, but it also paves the way for the translation of acquired knowledge (Kang & Snell, 2009). Lund Vinding (2006) found that an organization's active processes and its internal capability are the sine qua non for the effective acquisition, assimilation, and exploitation of knowledge. Knowledge absorption involves time and complexity while relying on structural capital. It shows that worldwide innovations owe much to structural capital (Aribi & Dupouët, 2015). Yang and Lin (2009) and Mubarik, Chandran, and Devadason (2016), concluded that the power

Relationships are more important than resources, particularly in networked environments (Lavie, 2006). Social capital facilitates knowledge acquisition and creation through external and internal resources. Problem-solving can be refined through improvements in social capital, which enhance performance (Youndt & Snell, 2004). Additionally, human capital is prerequisite for social capital, influenced and organized by structural capital and all together leads to innovativeness and business performance (Ahmed *et al.*, 2019; Huang & Hsueh, 2007). Figure 2 illustrates our framework called 'Intellectual Dynamics' that integrate DC and IC, in a holistic way and which is an outspread of empirical findings from many existent studies in the literature. Our study challenges common assumptions of DC and IC implicitness in knowledge dynamic ecosystem and advocates that integrability of all dimensions alters the impact on innovativeness mainly for practitioners. This theoretical framework could contribute to further systematic analyses and future research of DC and IC integrability and can provide reference for people to successfully predict innovativeness. Intellectual dynamics is a way to see DC and IC as interdisciplinary constructs which should not be analyzed separately. The points of convergence demonstrate that the perspectives of DC found in the literature (Ambrosini & Bowman, 2009; Teece 2007; Helfat *et al.*, 2007; Teece *et al.*, 1997) respect the same structure followed by IC (Subramaniam and Youndt, 2005; Bontis, 1998; Edvinsson, 1997) and both guided under knowledge acquisition, value creation and innovativeness to high performance. DC and IC influence each other in various forms and different contexts and are evidenced by studies mentioned a long this paper.

Thus, the integrability of these constructs is more than evident and demand new approaches from researchers to streamline future studies for practitioners about how use scientific findings in “intellectual dynamics” in practice. In this vein, we propose in Table 3 a brief description for Intellectual Dynamics which could be the first step of evolution for the literature in this field. In sum, following Wang, Su, Wang, and Zou (2019) who also disentangled the concept of IC and DC, which constitute a dynamic system, we posit that in these intellectual dynamics each of IC dimensions have a dynamic circular effect on knowledge ecosystem that demand specific capabilities. Human Capital enhances DC through the mechanisms of knowledge accumulation and new knowledge exploration. Structural capital acts on dynamic technology capability through organizational flexibility and DC. Social Capital embrace and demand the natural and important relations among the actors involve into this dynamic knowledge ecosystem through inherent DC to create rental ties.

summary of different points of view. The reason that firms are not always inclined to adopt theories in their routines is that it does not seem to be the wisest choice in terms of benefits, even because of theories' complexity or their unavailable access. Theories becomes more attractive for practitioners when they are readable or comprehensible for those that do not have all capabilities to understand scientific methods. Therefore, we believe that “intellectual Dynamics” may have the functions of analysis, and also provide predictive guidance for the recognition, strategy, and timing of innovativeness like other management theories do for management practices. Moreover, our findings also support Ahmed *et al.* (2019) at the argument that the components of IC are an important driver for dynamic capacities and vice-versa. This means that a capable workforce, efficient organizational systems, and good relationships with stakeholders facilitate knowledge acquisition, assimilation, transformation, and exploitation towards a differentiate performance.

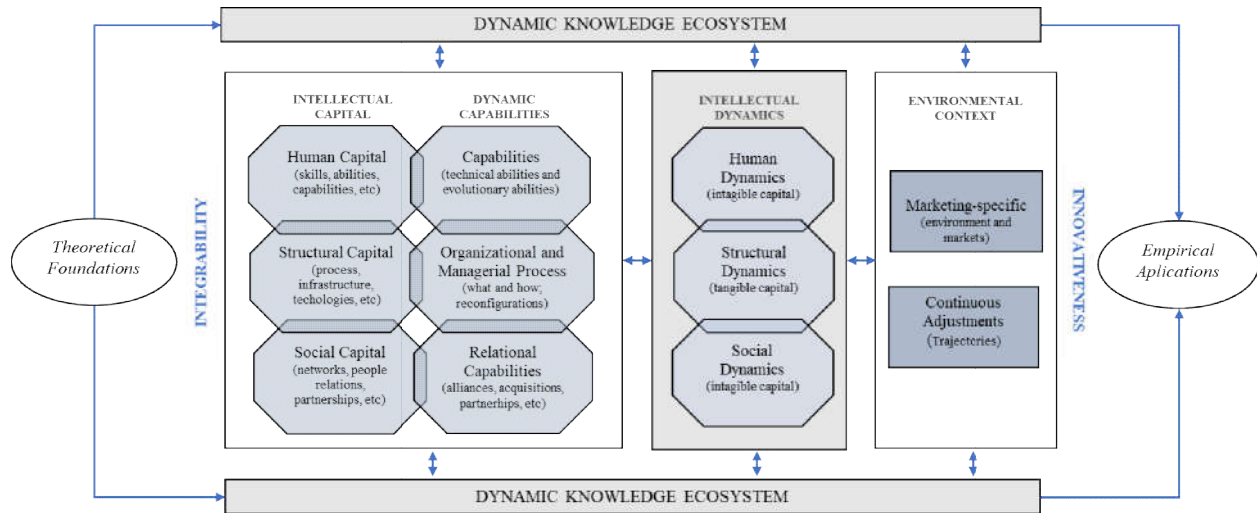


Figure 2. Intellectual Dynamics Integrative model of dynamic convergence between IC and DC

Table 3. Intellectual Dynamics description

Intellectual Dynamics	Description
Human Dynamics	Corresponding to the existence valuable, rare, inimitable, and non-substitutable capabilities possessed by human beings involved in the process of value creation and innovativeness that provide competitive advantage to firms. Its presence is supported by various sources such as, experience, academic background, training, learning, etc.
Social Dynamics	Corresponding to unique relational aspects that provide to firms a differentiated level of innovativeness against competitors enhancing knowledge ecosystems that impact human dynamics on value creation. Its presence is more effective when structural dynamics support and organize relations such as mergers, acquisitions, and alliances.
Structural Dynamics	Corresponding to the central base of specific processes, technologies and management that facilitate and formalize the relations among different actors in knowledge ecosystems and enhance agile transactions for innovativeness and value creation to firms. Its presence is highly impacted by human dynamics embedded in continuous adjustment of improvements during company’s trajectories towards value creation.
Knowledge Dynamics	Corresponding to the existence of human dynamics, structural dynamics and social dynamics that together contribute to create new trajectories and / or continuous adjustment for firm innovativeness, value creation and performance to attend market specific.

Note: Based on processed data by the authors

CONCLUSION

The main contributions of this paper can be divided into two aspects: theory and practice. In terms of the theoretical aspect, we pursue to streamline the theories that may hinder the understanding of them for innovativeness. We provide parallel perspectives definition for DC and IC based on its characteristics and processes through summarizing various points of view, so that we can clarify the fuzzy ideas and correct misinterpretations and misapplications of the theories.

Only by understanding the basic connotations and implications of the theory can researchers ensure that this theory might be discussed and developed in appropriate directions and useful practical implications (Si & Chen, 2020). In terms of the relationship between the theory and practice, we have tried to respond to the controversy of whether DC and IC can be meaningful to innovation practice and whether it can be used for predicting management practice through a systematic

So, this paper integrates the research streams DC and IC, thereby contributing to social science with one more interdisciplinary project (Buyalskaya *et al.*, 2021). Intellectual dynamics approach also provide a streamline of DC and IC to become closer the relationship between managers and researchers in the way of applying science into business. As continuous researchers, we must make sure that our future observation and approaches will be fully aligned with current empirical reality, market-specific and business needs. Further, in a nutshell, our content analysis shows the impact role for DC in the relationship between IC dimensions and innovativeness and vice-versa. Nevertheless, the magnitude of the impact may differ according to the trajectories and individual dimensions (Ahmed *et al.* 2019). This study has certain limitations, such as its cross-sectional nature and range. Future studies may pursue detailed analysis of DC and IC and investigate more restricted components to evolve in the intellectual dynamics approach. They could also explore the reasons why IC can have convergence with DC. Future research could also examine these ideas on longitudinal grounds to determine the

performance of intangible and tangible assets with relation to the capabilities of knowledge acquisition, assimilation, transformation, and exploitation, it mean, dynamic capabilities (DC).

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