



Firm Absorptive Capacity: Multidimensionality, Drivers, and Contextual Conditions

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Abstract

Purpose: The authors aim to enrich absorptive capacity literature by specifically highlighting and adding environmental conditions and internationalisation process to the original conceptualisation.

Design/Methodology/Approach: The authors undertake a conceptual analysis and present an enhanced framework of absorptive capacity by integrating multiple literature streams. The authors have analysed most relevant literature to provide underlying justifications for the proposed conceptual model.

Findings: Absorptive capacity ensures the long-term survival and success of a business. To develop absorptive capacity successfully, firms should focus on its various dimensions and existing intangible assets and external environment. The multidimensionality and richness of absorptive capacity is an under-explored area in the existing literature. We revisit the conceptualisation of absorptive capacity and add environmental conditions and the internationalisation process to the original conceptualisation. Absorptive capacity does not lead to a competitive advantage independent of its environment. To successfully develop it, firms have to adopt a holistic approach by considering the multi-dimensions, drivers, and contextual conditions of absorptive capacity.

Originality: This study contributes by conceptualising absorptive capacity as a dynamic capability. It is one of the first studies to specifically propose a framework that combines antecedents (prior knowledge, combinative capabilities, and IT capabilities), moderators (environmental conditions; namely, market and technological turbulence, competitiveness, and the internationalisation process), and consequences (competitive advantage). The study offers a unique conceptualisation with implications for researchers and managers. As a result, managers will have a well-defined blueprint to create value by utilising firm capabilities.

Paper Type: Conceptual Paper

Keywords: Combinative Capabilities, Information-Technology Capabilities, Potential Absorptive Capacity, Prior Related Knowledge, Realised Absorptive Capacity, Environmental Conditions

1. Introduction

A rapidly changing business environment poses challenges like globalisation, innovative value propositions, product and service proliferation, and time-to-market pressures. To achieve and sustain a competitive advantage, firms need a clear focus on external knowledge (Del Giudice and Maggioni, 2014; Ter Wal *et al.*, 2017). Therefore, identifying, adapting, and transforming the business in light of external knowledge is imperative for a firm's success (Lane *et al.*, 2006). Cohen and Levinthal define absorptive capacity (AC) as "*the ability of a firm to recognise the value of new, external information, assimilate it, and apply it to commercial ends*" (1990: p. 128). Academics over the last twenty-five years have been studying it to determine favourable AC factors (Cohen and Levinthal, 1990; Jansen *et al.*, 2009; Daspit and D'souza, 2013; Del Giudice *et al.*, 2017; Stulova and Rungi, 2017; Ter Wal *et al.*, 2017) illustrating the breadth of AC brought to the research field (e.g., Apriliyanti and Alon, 2017). Roberts *et al.* (2012) used the sponge as an example to explain AC, stating the purpose of the sponge is to absorb spilled water. Herein we expand on the concept of absorptive capacity, the focus of our study.

Scholars have also been recommending to further explore of AC micro-foundations. Initially, entrepreneurship literature incorporated this call (e.g., Gartner, 1989; Stevenson and Jarillo, 1990) and later echoed in the management research (Barney and Felin, 2013; Felin *et al.*, 2015; Helfat and Peteraf, 2015; Yao and Chang 2017). The micro-level actions of individuals are intertwined with firm-level outcomes (e.g., Lowik *et al.*, 2017). The individual interconnects various parts of the organisation with the environment and transforms opportunities into outcomes. The literature recognises the role of AC in knowledge generation (Distel, 2019; Kotabe *et al.*, 2017; Yao *et al.*, 2020). However, studies on the managerial influence on the firms' AC development are sparse despite repeated research calls, particularly "a deeper understanding of how firm-level absorptive capacity emerges from individuals' actions" (Cosaert *et al.*, 2018; Distel, 2019, pg. 2037). Also, researchers delve into the growing influence of digitisation (Ritter & Pedersen, 2020) and as an essential capability for building AC (Chen *et al.*, 2019). Finally, analysing how ideas travel through organisations over time, examining the individual contribution in the unfolding process (Ter Wal *et al.*, 2017; Crupi *et al.*, 2020; Scuotto *et al.*, 2017; Dahlander *et al.*, 2021).

In this study, we advance the absorptive capacity conceptualization through studying interactional influences. In particular, we conceptualize how environmental conditions (market turbulence, technological turbulence, and competitiveness) and the internationalization process

interplay between AC and competitive advantage. The study objective is to broaden the understanding of their interactional role to nurture firms' AC. Recent scholarly works (Dahlander *et al.*, 2021; Crupi *et al.*, 2020; Contractor *et al.* 2019; Ter Wal *et al.*, 2017) emphasize exploring strategy formation focus on the firm as their unit of analysis ignore the individuals engaged in decision making. Hence our study builds on those interacting individuals to uncover any causal agents by going below the firm level. The dissection of firm-level constructs to comprehend how individual-level determinants interactions influence firms. This comprehension identifies how individual action-driven processes translate into resulting outcomes. It can be accomplished by exploring individual decision-makers in departments as the unit of analysis.

This study contributes to the existing AC literature in three ways. First, it revisits the conceptualisation and multidimensionality of AC. We integrate the concept of AC into the Information Systems (IS) field by combining digitisation and organisational capabilities. Fast diffusion and convergence significantly support the development and maintenance of AC (Roberts *et al.*, 2012). Firms combine technology-focused investments to create digital capabilities, which enhance AC (Gold *et al.*, 2001). Roberts *et al.* (2012) emphasise the synergetic influence of digitisation and the effect of complementary organisational capabilities on a firm's AC. Due to technological turbulence, digital technologies are diffusing and converging rapidly. Therefore, it is crucial to understand the interactional role of environmental conditions and the internationalization process and their influence on firms. We extend the model by adding environmental conditions (namely market turbulence, technological turbulence, and competitiveness) and the internationalization process to the initial conceptualization of Cohen and Levinthal (1990) as well as later seminal works by Zahra and George (2002); Lane *et al.*, (2006); and Todorova and Durisin (2007). We also contribute to the existing literature by presenting a revised conceptualization including formal and informal factors by responding to the recent calls by Kotabe *et al.* (2017), Yao and Chang (2017), and Distel (2019).

Second, the study proposes a revised conceptual model. It combines antecedents (prior knowledge, combinative capabilities, and digital capabilities), moderators (environmental turbulence and the internationalisation process), and the consequences of AC on competitive advantage in a single conceptualised model. The purpose of such an amalgamation is to provide a holistic view that enables managers and practitioners to thrive and maintain and enhance a

firm's AC. The unit of analysis is an individual driving the firm, answering the long-standing calls for this micro-foundations' perspective. We expect that our reconceptualisation will open up opportunities for future scholars to explore this rich construct, building on its individual- and organisational-level antecedents, outward-looking and inward-looking facets, and cost dimensions. More explorative efforts in a micro-foundations perspective of AC will facilitate managers' ability to use organisational antecedent knowledge to influence future goals, such as innovation, competitive advantage, and performance.

Third, the proposed framework contributes by bridging the gap in the micro-foundation-based limitations highlighted by Roberts *et al.* (2012); Barney and Felin (2013); Felin *et al.*, (2015); Coviello *et al.* (2017); Yao and Chang (2017); and Chen *et al.* (2019). By focusing on the interacting individuals, going below the firm-level enables comprehending how individual-level determinants influence firms. This comprehension identifies how individual action-driven processes at the micro-foundations level translate into macro-foundational level outcomes. Our work addresses the research opportunity identified by and further builds on the seminal work of Volberda *et al.*, (2010); Lewin *et al.* (2011); He *et al.* (2015); and Distel (2019).

The remainder of the paper is organised into two parts. The first part presents the theoretical background and discusses the revised conceptualisation and propositions that the study tries to interconnect. The second part serves the purpose of providing the theoretical base for future empirical studies.

2. Theoretical Background

To be innovative, a firm should improve its AC (Cohen and Levinthal, 1990), enabling its sustainable success (Zahra and George, 2002; Todorova and Durisin, 2007; Singh *et al.*, 2020). However, to develop AC successfully, Daspit and D'souza (2013) recommend that firms focus on the multidimensionality of AC and the firm's existing intangible assets and environment. AC is a useful tool to explain inter-firm inconsistencies. Although studies have been referencing the absorptive capacity dimensionality, the body of research is inconsistent and fragmented, quoting the construct as comprising of two (e.g., Zahra and George, 2002), three (e.g., Lichtenthaler, 2009), and/or internal capabilities (e.g., Sun and Andersson, 2012). However, research suggests, not many studies are able to capture the multidimensionality and

richness of AC (e.g., Jansen *et al.*, 2005; Lichtenthaler, 2009; Kor and Mesko, 2013; Valentim *et al.*, 2016; Yao and Chang, 2017; Cosaert *et al.*, 2018; Song *et al.*, 2018; Distel, 2019).

2.1 Cohen and Levinthal's Pioneering Conceptualization of AC

Cohen and Levinthal (1989 and 1994) provide the most influential concept of AC. They introduce the term as an ability of the firm to innovate and be dynamic. Building on this, Mowery *et al.* (1996), Dyer and Singh (1998), Zahra and George (2002), and Todorova and Durisin (2007) further strengthen the understanding of this concept. Cohen and Levinthal (1990) suggest that AC is a function of the level of prior related knowledge. Mowery and Oxley (1995) defined AC as a set of skills used for the tacit part of transferred knowledge and modifying imported knowledge. Kim (1997, 1998) provides a third definition: an ability to learn and solve problems. From these definitions viewing AC as a multidimensional concept, Zahra and George (2002: p. 186) define "AC as a set processes, by which firms attain, integrate, transform, and exploit knowledge to produce a dynamic organisational capability." To understand the evolution of the concept AC and related theoretical models, we start with a discussion of the original work of Cohen and Levinthal (1989, 1990, and 1994).

Cohen and Levinthal (1989) definition of AC is grounded in economic theory. While discussing the costs associated with AC, the authors argue that the willingness to invest in creating a firm's AC depends on learning incentives. The firm perceives these incentives from its environment. This perception is, in turn, a function of different exogenous factors. These factors are the scope of technological opportunities, knowledge appropriability, and industry demands of growth and income elasticity. The researchers suggest a positive relationship between each of those constructs and R&D spending.

Additionally, the relationship of appropriability and opportunities with investment in R&D is moderated by the ease of external knowledge learning. In addition, the effect of appropriability on R&D spending is positively moderated by industry competitiveness but negatively moderated by a product's price elasticity. Finally, the researchers propose that R&D spending is an antecedent of AC. These relationships are given in table 1. Their research was later critically examined by Lane *et al.* (2006). They state that R&D spending is a 'problematic' measure as it does not treat AC as a process or a capability but instead as a static resource.

The second study by Cohen and Levinthal (1990) posits the same relationships as their 1989 study. However, in the 1990 study, they consider individuals' cognitive structures and problem-solving skills to provide a richer discussion of the AC construct at the individual level. A third study, 'Fortune Favors the Prepared Firm', by Cohen and Levinthal in 1994, redefines AC. The definition is again grounded in economic theory. They extend their earlier definition by adding a firm's capability of using the newly assimilated knowledge to forecast technological trends and advances. The study also contributes by explaining how AC helps firms take advantage of emerging technologies ahead of their competitors. Their model investigates the investment decision of monopolists and the effect of new entrants on the incumbent's investment behaviour.

[Table 1 Appears About Here]

2.2 Later Conceptualisations of AC

Based on the primary foundation laid down by Cohen and Levinthal (1989, 1990), the AC's definition was extended in 1996-2002 by Dyer and Singh (1998), Kim (1997, 1998), Van den Bosch *et al.* (1999), and Zahra and George (2002). The purpose of all of this research was to shift AC away from R&D and towards a dynamic capability perspective. In this work, a few researchers attempt to capture its multidimensionality. Others shed light on the drivers/antecedents, contingent factors/moderators, or benefits/consequences of AC. Later on, the concept was conceptualised and reified by Lane *et al.* (2006), Zahra and George (2006), and Todorova and Durisin (2007). Recently, among others, Park and Harris (2014), Ter Wal *et al.* (2017), and Distel (2019) also expand the concept. We discuss these studies below and their comparisons with Cohen and Levinthal's work.

Zahra and George (2002) conceptualise AC as a dynamic capability that helps firms create and utilise new external knowledge to achieve and sustain competitive advantage. They consider AC at the organisational level. They suggest a conceptual model and identify its antecedents, components, contingencies, and outcomes. Their model contrasts the model of Cohen and Levinthal (1990) as they divide AC into two capacities, namely, potential absorptive capacity (PAC) and realised absorptive capacity (RAC). Though both are rooted in Cohen and Levinthal's definition of AC, Zahra and George (2002) substitute 'acquisition' for 'recognising the value' and add a new capability, 'transformation'.

PAC is based on two components or capabilities: attainment and integration of new external knowledge. In contrast, RAC is based on the transformation and exploitation of knowledge commercially. In addition to these differences, Zahra and George relocate 'regimes of appropriability' and add two other contingencies: activation triggers and social integration mechanisms. They use competitive advantage as an outcome of AC that comprises innovation, strategic flexibility, and performance. According to them, earlier studies were able to capture the output of RAC in terms of innovativeness and other outcomes while ignoring the outcome of PAC. Therefore, they propose that PAC results in strategic flexibility. This provides firms with the degree of freedom to adapt in a dynamic environment and hence helps them achieve sustained competitive advantage. The question arises as to why Zahra and George conceptualise AC as a dynamic capability and base it on four dimensions. Dynamic capability helps firms in bringing organisational changes that are strategic in nature. Given the path dependencies and market positions, it helps firms achieve new forms of competitive advantage.

Teece (2016) recommends that managers acquire essential resources and stay abreast of critical trends that support organisational capabilities development to address environmental changes. Similarly, Gross (2017) argues that managers' strategic thinking plays an important role in these determinations. Zahra and George (2002) split AC into the four capabilities of attainment, integration, transformation, and use of knowledge as they can combine to provide the dynamic capability. They conceptualise the dimensions based on prior definitions- knowledge acquisition (Mowery and Oxley, 1995), assimilation and exploitation (Cohen and Levinthal, 1990), the transformation (Kim, 1998). In addition to the four dimensions of AC, Zahra and George (2002) also focus on internal knowledge sharing and integration. These social integration mechanisms are a critical part of APCP as they help increase AC by reducing the gap between assimilation (PAC) and transformation (RAC).

Table 2 appears here

Lane *et al.* (2006) consider reification of AC in later research based on the initial work of Cohen and Levinthal (1989, 1994). To Lane *et al.* (2006), reification has implications for knowledge development and learning. They provide suggestions to minimise reification in the future by outlining a set of five assumptions that limit the progress of research on AC. Based on these AC is defined as a firm's ability to utilise external knowledge through a sequence of three learning processes: exploratory, transformative, and exploitative learning. They propose

a model of these processes, drivers, and outcomes. They also include a feedback loop from commercial and knowledge outputs to firms' future AC.

Todorova and Durisin (2007) criticise the reconceptualisation of Zahra and George (2002) on the basis of the Cohen and Levinthal (1989, 1990, and 1994) studies. They propose a refined model that is a call back to the original work of Cohen and Levinthal. Their model addresses all the ambiguities and limitations by offering substantive changes to Zahra and George's model. First, they reintroduce the 'recognising the value' ability in the AC process. They suggest that the transformation process, added by Zahra and George, does not come after assimilation. Assimilation and transformation are alternative processes of AC, which are linked by multiple paths in the model. This modification of the model blurs the clear boundary line between PAC and RAC. Second, Todorova and Durisin (2009) also suggest modification in using contingent factors in the model. They posit that social integration mechanisms affect the other components of AC. They introduce another moderator—power relationships that affect recognising the value and exploitation ability. The third contingent factor is regimes of appropriability, which influence the relationship between AC and competitive advantage and between prior knowledge and AC. Finally, the researchers add a feedback link to capture the dynamic perspective of AC (see, e.g. Park and Harris, 2014; Martinkenaite and Breunig, 2016; Wal *et al.*, 2017; Distel, 2019).

2.3 Reconceptualisation of AC

This section revisits the AC literature and builds on the influential studies discussed in the previous section. The revisit helps to analyse the multidimensionality of AC deeply as a dynamic capability. Additionally, it helps explore the role of different capabilities and prior knowledge as antecedents, environmental factors as moderators, and competitive advantage because of AC. In general, AC antecedents have been categorised into three groups: inter-organisational, intra-organizational, and managerial (Rezaei-Zadeh and Darwish, 2016). To provide a holistic view, in this study, we combine scattered antecedents and moderators based on the research gaps identified in prior research. Though Cohen and Levinthal (1990) explore the role of environmental factors in their framework and emphasise the importance of organisational mechanisms, there is still scarce literature on antecedents (e.g., Lane *et al.*, 2002) and environmental influences (Lane *et al.*, 2006; Argote *et al.*, 2020).

Moreover, adding IT capability to the existing framework allows testing its role in improving competitive advantage while the industry is facing continuous technological turbulence. The literature begins with a discussion of prior seminal research. It then proceeds with exploring antecedents, contingency factors, and their relationships with AC and competitive advantage. The example of the sponge presented by Roberts *et al.* (2012) example of sponge simplifies the concept of AC. Similarly, AC aims to absorb knowledge available outside. It is well known that to be innovative. A firm should enhance its AC (Cohen and Levinthal, 1990). To achieve long-term survival and success, a firm should develop and maintain AC (Zahra and George, 2002; Todorova and Durisin, 2007). But organisations do not always succeed in developing desirable AC. Some pioneering firms like Procter and Gamble received benefits from external knowledge, whereas many other firms faced difficulties (Huston and Sakkab, 2006). Coviello and Joseph (2012) illustrate that participants add informational, technical, and financial inputs in influencing the process of product development and are instrumental in global diffusions of the innovation. This external perspective has invigorated the traditional conceptualisation as, for digital firms, the hard to imitate and valuable intangible assets should include the participant community and the networks, information, and resource benefactions of participants (Shankar and Bayus, 2003; Sun and Tse, 2009). However, based on researchers' opinions in several studies, firms primarily define how the customers participate in innovation (Coviello and Joseph, 2012).

To reap the benefits, firms have to focus not only on the multidimensionality of AC but also on the existing knowledge base, different capabilities, and the external environment in which they are operating. Unfortunately, so far, only a few studies have captured the multidimensionality and richness of AC (Jansen *et al.*, 2005; Lichtenthaler, 2009; Kor and Mesko, 2013; Valentim *et al.*, 2016; Yao and Chang, 2017; Cosaert *et al.*, 2018; Song *et al.*, 2018; Distel, 2019). Therefore, our study revisits the AC concept and extends its understanding as a dynamic capability. In addition, our work combines different organisational antecedents, environmental moderators, and outcomes in a single study. The purpose is to provide a holistic view to enhance firms' AC.

Jansen *et al.* (2005) examine the impact of three combinative capabilities (socialisation, systems, and coordination) on AC. These researchers do not add digitisation capability as a key organisational antecedent of AC. Our research extends their framework by incorporating additional organisational antecedents, environmental moderators, and outcomes. This study

combines digitisation capability with combinative capabilities and includes moderators and consequences of AC. Roberts *et al.* (2012) consider the synergistic influence of digitisation capability and two complementary organisational capabilities (coordination and socialisation) on AC. Noteworthy is that they suggest future researchers add other capabilities and innovation outcomes to their proposed framework.

Finally, Lichtenthaler (2009) adopts the process-based view of AC introduced by Lane *et al.* (2006). He investigates the moderating effects of market and technological turbulence on learning processes' performance and innovation outcomes. However, this research did not include environmental competitiveness in its framework. Also, he suggests including antecedents of complementary learning processes. Hence, our proposed framework includes prior knowledge and capabilities as crucial antecedents. Figure 1 below presents the proposed integrative model of AC.

[Figure 1 Appears About Here]

As indicated, AC influences a firm's ability to gain an advantage over competitors in a dynamic business environment. This is more pronounced for ambidextrous firms. This study is an attempt to help ambidextrous firms invest in innovative projects. The framework provided by our study will simplify the process of creating AC and developing new products or services to fulfil the changing needs of the market and customers. It will also help firms emphasise and integrate combined digitisation efforts, coordination, firm routines, and socialisation capabilities. These mechanisms and the firm's existing knowledge base make it easier to develop and enhance AC and improve its overall performance in a turbulent and competitive environment.

3. Multidimensionality of Absorptive Capacity

From a practitioner's viewpoint, managers struggle in understanding how firm-level dynamics (e.g., social integration mechanisms) are employed to enrich the firm's new knowledge acquisition and usage ability. Dasgupt and D'Souza, 2013 see an inadequate understanding of the inter-relation of capabilities. Hence, before offering specific insight into the absorptive capacity influence, one should first understand leveraging of the internal capabilities construct. An improved capability understanding associated with absorptive capacity will facilitate

amalgamate the absorptive capacity phenomenon understanding. As a result, managers will have a well-defined blueprint to create value by utilising firm capabilities.

3.1 Competitive Advantage as an Outcome of AC

Our study adopts the dimensions of AC suggested by Zahra and George (2002). According to them, AC is a dynamic capability that firms use to create and utilise new knowledge to achieve a competitive edge over other firms. The authors view AC at the individual level, which collectively influences at the organisational level. They divide four dimensions into two different sets of AC, namely, PAC and RAC. Firms that focus on the two prior dimensions can continuously renew knowledge stocks but may pay high costs to acquire new knowledge without even getting benefits from its utilisation. On the other hand, firms who focus on the last two dimensions can receive short-term benefits by exploiting valuable knowledge but may fail to respond to environmental conditions and may suffer from a competence trap. Therefore, there is a dire need to explore the role of antecedents and environmental conditions on PAC and RAC separately, resulting in sustainable competitive advantage.

As mentioned, competitive advantage measures benefits received from a firm's AC ability. Cohen and Levinthal (1990) propose that an enhanced ability of AC helps firms gain long-term and sustainable leadership in terms of innovation and innovation performance. Todorova and Durisin (2007) argue that innovation and innovation performance can only measure the benefits received from a firm's abilities of transformation and exploitation—realised AC. To realise the benefits of acquisition and assimilation abilities—potential AC—both studies add strategic flexibility from Cohen and Levinthal's list. However, Lane *et al.* (2006) include three outcomes in their study based on the reification of AC. These outcomes are knowledge outputs, commercial outputs, and firm performance. They explain that knowledge outputs and commercial outputs are predecessors of firm performance.

3.2 Antecedents of Absorptive Capacity

3.2.1 Prior Related Knowledge

Cohen and Levinthal (1989) point out that 'a stock of prior knowledge...constitutes the firm's AC'. In another study, Cohen and Levinthal (1990) mention that AC 'is largely a function of prior knowledge'. Ford (1996) also suggests that prior related knowledge primarily forms

the content of AC. Similarly, Van den Bosch *et al.* (1999) consider prior related knowledge as a determinant of AC. Firms acquire new information from various sources. The diversity of sources influences the firm's PAC. External sources may include contractual agreements and inter-organisational relationships. The literature has already recognised the role of AC in the generation of knowledge (Kotabe *et al.*, 2017; Distel, 2019). Organisations realise the importance of external knowledge and invest in AC development (Yao and Chang, 2017).

As discussed earlier, Zahra and George (2002) conceptualise AC and its dimensions based on a dynamic capability perspective. Their proposed framework states that external knowledge sources and prior knowledge are antecedents of potential APCP, which comprises the attainment and assimilation of new knowledge. On the other hand, Todorova and Durisin (2007) propose that prior related knowledge does not directly impact acquisition, as shown by Zahra and George. According to Todorova and Durisin, knowledge sources and prior knowledge are important for firms to recognise the value of knowledge available outside and that firms intend to acquire. This shows that the first building block of AC is 'recognising the value', whereas 'acquisition' is the second. Therefore, the researchers posit that knowledge sources and existing related knowledge impacts the firm's ability to realise the value.

Roberts *et al.* (2012) distinguish between epistemic and behavioural dimensions of AC. The epistemic dimension refers to the knowledge base or what a firm knows. It consists of implicit and explicit ideas, beliefs, facts, frames, and conceptual structures an individual of a firm possesses. According to a resource-based view, this dimension is based on human and intangible resources (Bharadwaj *et al.*, 1999). The epistemic dimension is path-dependent, and it is a function of awareness and experience. This shows that it is critical for acquiring new and external knowledge (Cohen and Levinthal, 1990). Roberts *et al.* (2012) divide AC's knowledge base or epistemic dimension into three factors: knowledge diversity, knowledge depth, and knowledge linkages. While prior knowledge assists in recognising opportunities in the same or new areas, it also escalates the risk of becoming rationally bound (Prandelli *et al.*, 2016). As organisational employees are conduits of new knowledge creation they influence relational embeddedness (Ebers and Maurer, 2014).

The above discussion elaborates that the existing knowledge base affects firm's ability to attain, assimilation, and exploit new knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002; Lane *et al.*, 2006; Todorova and Durisin, 2007; Volberda *et al.*, 2010; Roberts *et al.*, 2012;

Rezaei-Zadeh and Darwish, 2016). Furthermore, the prior knowledge is influential in value recognition as well as opportunity recognition; therefore, we propose the following:

Proposition 1: Prior related knowledge of a firm enhances its ability of AC, which in turn helps firms achieve competitive advantage.

3.2.3 Combinative Capabilities

Combinative capabilities are the vital determinants of AC as they enable firms to attain and utilise current and new knowledge (Kogut and Zander, 1992). Cohen and Levinthal (1990) emphasise the significance of internal mechanisms for a firm's AC. In another study, they state that AC is based on other related abilities. Combinative capabilities are based on common features that involve various mechanisms, such as participative decision making (Eisenhardt and Martin, 2000), formal and informal structures (Matusik, 2002), dominant values, and control systems (Henderson and Cockburn, 1994). According to Verona (1999), organisational capabilities that enhance AC are linked with managerial structures, social relations, and systems.

Van den Bosch *et al.* (1999) differentiate between various types of combinative capabilities: coordination capabilities, systems capabilities, and socialisation capabilities. Similarly Jansen *et al.* (2005) propose specific mechanisms as common features of these capabilities. Van den Bosch *et al.* (1999) analyse the impact of each combinative capability on the level of overall AC, whereas Jansen *et al.* (2005) analyse the impact of each capability on each component of AC separately; namely, PAC and RAC. Jansen *et al.* (2006) study internal knowledge acquisition and study the impact of organisational antecedents on exploratory and exploitative innovation; both subsequently affect financial performance of ambidextrous organisations. They include formal and informal coordination mechanisms in their list of organisational antecedents.

3.2.3.1 Coordination Capabilities

Coordination capabilities improve knowledge exchange and knowledge absorption through building relations among group members. The members in a group undertake several ways of coordination. Such coordination methods may be designed or emerge from interactions with each other (Van den Bosch *et al.*, 1999). Thus, coordination capabilities enable firms to exchange information across boundaries, including hierarchical and disciplinary boundaries

(Teece *et al.*, 1997). Van den Bosch *et al.* (1999) divide coordination capabilities into three mechanisms: training and job rotation, participation, and natural liaison devices. They use coordination capability as the determinant of AC and investigate its low or high impact on knowledge absorption in terms of efficiency, scope, and flexibility. They confirm a positive impact of coordination capability on a firm's level of AC.

However, Jansen *et al.* (2006) consider two different categories of coordination capabilities. They examine the implications and impact of both types of coordination mechanisms on the exploratory and exploitative innovation of ambidextrous organisations, impacting financial performance. These two categories are formal hierarchical structure and informal social relations. They group centralisation of decision making and formalisation of rules, procedures, instructions, and communications into formal coordination mechanisms. In contrast, they view connectedness among members of a social network as an informal coordination mechanism. Jansen *et al.* (2006) note that centralisation undermines exploratory innovation, but formalisation enhances exploitative innovation. Connectedness among members is a significant antecedent of both types of internal innovation.

Jansen *et al.* (2005) study cross-functional interfaces, job rotation, and participation in decision making as common features of coordination capability and note that such interfaces result in joint decision making processes and lateral forms of communication that enable firms to deepen their knowledge across lines of authority and functional boundaries. Cohen and Levinthal (1990) view that personal contacts across different functions, interactions between functional areas, and liaison roles raise AC. Research has established intra-organizational factors that affect AC. These factors are cross-functional interfaces, job rotation, formalisation, and routinisation (Adams *et al.*, 2016); structural and human capital (Engelman *et al.*, 2017); and R&D intensity (Tsai, 2001). Therefore, we propose the following:

Proposition 2a: Cross-functional interfaces positively affect PAC (acquisition and assimilation) and RAC (transformation and exploitation), which may lead to a competitive advantage.

The second organisational mechanism associated with coordination capability is decision making participation. According to Khandwalla (1977), participation can result in knowledge integration and absorption in a situation when delegation is a necessity. According to Van den Bosch *et al.* (1999), a low level of employee participation in decision-making results in a low level of knowledge sharing. A high level of participation, on the other hand, results in

a richer knowledge architecture. Similarly, Jansen *et al.* (2005) argue for the positive impact of participation by employees in decision making on acquisition and assimilation, whereas a negative impact on transformation and exploitation of knowledge. Also, the types of knowledge flow and organisational integration (Distel, 2019) influence AC. Therefore, we propose the following:

Proposition 2b: Employees' participation in decision-making positively affects potential AC (acquisition and assimilation), which leads to a competitive advantage.

The third organisational mechanism associated with coordination capability is job rotation, which means the lateral transfer of employees among different jobs. Cohen and Levinthal (1990) assume that job rotation increases redundancy and diversity, helps improve problem-solving skills, and develops organisational contacts. Diversity of knowledge structures enhances explorative learning (McGrath, 2001). Mumford (2000) argues that job rotation develops organisational contacts and coalitions. The coalitions support exploitation learning. Van den Bosch *et al.* (1999) are of the view that education, training, and job rotation help firms coordinate and absorb knowledge. Jansen *et al.* (2005) and Adams *et al.* (2016) posit that formalisation, training, routinisation, and job rotation help firms improve their ability of AC. We propose the following:

Proposition 2c: Job rotation positively affects PAC (acquisition and assimilation) and RAC (transformation and exploitation), which subsequently influences a firm's competitive advantage.

3.2.3.2 Socialization Capabilities

Socialisation capabilities are defined by Van den Bosch *et al.* (1999, p. 557) as the firm's ability 'to produce a common ideology that offers an identity and collective interpretations of the reality'. In terms of systems of ideology, these capabilities result from the organisation's culture. Cohen and Levinthal (1990) highlight that firms whose actors or members all use the same language cannot absorb diverse external knowledge. Van den Bosch *et al.* (1999) endorsed Cohen and Levinthal's view, arguing that strong culture slows down change and resists deviation. Organisations that practice socialisation mechanisms possess a strong identity, common language, shared values, a coherent set of beliefs, and strongly agreed upon attitudes. Firms with such a culture are weak in absorbing external knowledge. Therefore, the researchers posit a negative influence of socialisation capabilities on AC. Like coordination capabilities, socialisation capabilities are also path-dependent.

Camerer and Vepsäläinen (1988) elaborate that socialisation mechanisms can influence AC by specifying the rules for suitable actions under unspecified contingent situations. These rules are broad and tacitly understood by the organisational members. Zahra and George (2002) and Todorova and Durisin (2007) include social integration mechanisms as a contingency factor in the AC model. According to Zahra and George (2002), social integration mechanisms help firms reduce the gap and barriers between the assimilation (PAC) and transformation (RAC) dimensions of AC. In contrast to Zahra and George, Todorova and Durisin (2007) argue that social integration mechanisms impact all four dimensions of AC. They further argue that this impact can be positive or negative depending on the knowledge type and the knowledge processes. In addition, many other studies propose the positive influence of social integration mechanisms on AC, creative behaviour (Distel, 2019), dominant logic (Eggers and Kaplan, 2009), leadership styles (Flatten *et al.*, 2015), and learning goal orientation (Yao and Chang, 2017). Therefore, we propose these propositions:

Proposition 3a: Strong connectedness among organisational members negatively influences the acquisition and assimilation ability of a firm, which influences its competitive advantage.

Proposition 3b: Strong connectedness among organisational members enhances the level of transformation and exploitation of external knowledge, which subsequently improves competitive advantage.

The second organisational mechanism or commonality of socialisation capability is socialisation tactics. Ashforth and Saks (1996) explain that socialisation tactics help develop shared social experiences. This improves interpersonal relationships and results in the similarity of values and beliefs among unit members. However, the researchers further argue that socialisation tactics result in a custodial role, which leads to the status quo due to a high level of similarity of beliefs among members. This may limit the ability of members to search for new sources of external knowledge (Cohen and Levinthal, 1990). Jansen *et al.* (2005) also suggest a negative influence of socialisation tactics on PAC, which is determined by the acquisition and assimilation of new knowledge.

On the other hand, when firms facilitate socialisation, tactics may improve the combining of existing knowledge and newly acquired external knowledge (Zahra and George, 2002). This develops the members' commitment to learning by strengthening social norms, values, and beliefs (Adler and Kwon, 2002). Similarly, Jansen *et al.* (2005) posit a positive effect of this mechanism on realised AC determined by transformation and exploitation ability.

Also, managerial cognition (Volberda *et al.*, 2010), strategic thinking (Gross, 2017), and systems thinking (Kim *et al.*, 2014) influence AC. Therefore, we propose these:

Proposition 3c: Socialisation tactics shared among organisational members negatively influence the acquisition and assimilation ability of a firm, which influences its competitive advantage.

Proposition 3d: Socialisation tactics positively influence the transformation and exploitation of external knowledge, which subsequently improves competitive advantage.

3.2.3.3 Systems Capabilities

The third combinative capability is systems capability, which refers to the firm's ability to shape and program the behaviour of members before execution and results in memory for handling routine situations (Galbraith, 1973; Van den Bosch *et al.*, 1999). Van den Bosch *et al.* (1999) relate these mechanisms to policies, directions, documents, and procedures/methods. Unlike coordination capabilities, system capabilities allow explicit knowledge absorption by following set procedures and rules. System capabilities explain how policies, rules, communications, procedures, or instructions are systemised and formally written down in documents. The explicit knowledge is shared among members using formal language, written procedural manuals, and information systems. Hence such capabilities result in routine handling of situations.

Some studies identify managerial, strategic thinking (Pisapia *et al.*, 2005; Gross, 2017) and systems thinking (Kim *et al.*, 2014) as influencing factors for AC. This further leads to programmed and predictable behaviours of members. Such predictability and routine situations hinder the firm's ability of AC. That's why Van den Bosch *et al.* (1999) assume that systems capabilities negatively impact AC and knowledge absorption in the firm. The common features and organisational mechanisms related to systems capabilities are formalisation and routinisation (Cohen and Bacdayan, 1994; Jansen *et al.*, 2005; Adams *et al.*, 2016). Formalisation is the firm's ability to write down or formalise the procedures, communications, rules, and instructions. Such mechanisms hinder the individual's ability to diverge from established behaviour. This circumstance then restricts a firm's exploration of learning (Weick, 1979). Based on this argument, we propose the following:

Proposition 4a: A higher degree of formalisation hinders the acquisition and assimilation of valuable external knowledge, which subsequently affects competitive advantage.

On the other hand, Benner and Tushman (2003) argue that formalisation may reduce deviation and variance by allowing incremental changes in different processes and outputs. This helps in generating proposals that can improve existing routines. These improvements then become part of the standardised practices and actions. In short, formalisation ends up in the codification of best practices. This ultimately results inefficient practices, which are easy to exploit, apply, and implement. Zollo and Winter (2002) view that formalisation improves the possibility that members will pursue opportunities to transform external knowledge. Similarly, Jansen *et al.*, (2005), Jansen *et al.* (2006), and Adams *et al.* (2016) maintain that a higher level of formalisation leads to a higher level of exploitative learning in a firm. Therefore, we propose the following:

Proposition 4b: A firm's higher level of formalisation positively affects the firm's ability to transform valuable external knowledge and exploit it for commercial ends, which subsequently affects the competitive advantage.

The second commonality of systems capability is routinisation. System capabilities result in routine situations and individuals' predictable behaviour in those situations (Van den Bosch *et al.*, 1999). Routinisation refers to the ability of a firm to establish a sequence of tasks that needs little attention (Galunic and Rodan, 1998). The sequence of tasks and routines ensures the transformation of inputs into outputs. Firms practicing routine tasks fall into repetition traps and do not experience new events and novel problems. Such practices hinder a member's ability to search for and interpret new knowledge. This represents a negative influence of routinisation on a firm's PAC (Jansen *et al.*, 2005).

However, Cohen and Bacdayan (1994) argue that routinisation provides firms efficient structures for collective actions. These structures help reduce the effort and time spent on implementation and decision making. Thus, the result is that routinising organisational behaviour enables firms to transform valuable external knowledge into their existing set of activities. Adler *et al.* (1999) are of the view that organisational members who practice routine and predictable tasks allow coordinated knowledge exploitation to pursue their collective objectives. Jansen *et al.* (2005) also posit that routinisation improves transformation and exploitation abilities. Therefore, we propose these:

Proposition 4c: A firm's ability to routinise tasks reduces its ability to acquire and assimilate new external knowledge, which may result in a loss of competitive advantage.

Proposition 4d: Routinisation positively influences a firm's ability to transform valuable external knowledge and exploit it for commercial ends, thereby improving competitive advantage.

3.2.4 Technological Capabilities (TC)

New technologies offer organisations striking opportunities to compete globally using digital platforms and various technologies, such as additive manufacturing, big data and analytics, the Internet of things, and robotic systems (Strange and Zucchella, 2017; Chen, Shaheer, Yi, and Li, 2019). These evolving technologies play a vital role in creating and enhancing AC and should not be ignored in AC and information studies (Roberts *et al.*, 2012). Roberts *et al.* (2012) highlight that there are a limited number of investigations linking TC and AC. Even though the organisational learning literature is far-reaching and broad, Bapuji and Crossan (2004) and Gupta *et al.* (2006) identify exploration and exploitation (March 1991) as twin pillars of organisational learning research. As Cohen and Levinthal (1990) argued, the AC of a firm depends on individuals' knowledge and their mental models. These mental structures help them scan the environment, acquire knowledge, and apply it to produce goods/services. However, bounded rationality constrains all such mental abilities of an individual. It obstructs an individual's AC and, as a result, limits a firm's ability to AC. Nonetheless, information technology helps individuals enhance their communication and computational abilities (Bakos and Treacy, 1986). Hence, TC loosens the limits of bounded rationality and subsequently improves AC.

The rapid convergence of technologies provides significant opportunities to improve the firm's ability of knowledge absorption. Emerging technologies disrupt traditional business models and reconfiguring organisational processes, routines, and structures (Brouthers *et al.*, 2016). Firms now invest in enterprise resource systems, open architectures, common data repositories, infrastructural technologies, and more. They combine these technological investments with other organisational assets. These cumulative efforts create technological capabilities that ultimately help them enhance AC (Gold *et al.*, 2001). Moreover, firms configure their supply chain with TC enabled AC to process the external knowledge received from their partners (Scuotto *et al.*, 2017). This new knowledge helps firms achieve competitive advantage (Roberts *et al.*, 2012).

Roberts *et al.* (2012) propose a framework to investigate the role of TC in AC literature. They propose that synergies of technological capabilities and complementary organisational capabilities positively influence a firm's ability of AC. The complementary organisational capabilities are divided into knowledge exchange coordination capabilities and knowledge exchange socialisation capabilities. Like Jansen *et al.* (2005), Roberts *et al.* (2012) suggest separately investigating the influence of capabilities on each dimension of AC. The limitation of Roberts *et al.* (2012) study is ignoring the outcome of AC in the framework. Moreover, they suggest that more organisational mechanisms may be added to TC, coordination, and socialisation mechanisms in future studies.

Table 3 appears here

Wade and Hulland (2004) distinguish between three forms of technological capabilities: outside-in capabilities, inside-out capabilities, and spanning capabilities. (a) Outside-in capabilities are outward-facing. These capabilities help firms to create external relationships and identify and collect external knowledge, thus building knowledge identification capability. An inter-organisational E-business interface is an example of outside-in capability. (b) Inside-out is an inward-focused capability that helps firms seize opportunities and apply newly acquired knowledge to create new products and services, developing knowledge application capability. An integrated information system is an example of inside-out capability. (c) Spanning assimilates the first two capabilities and helps firms in integration or transformation. Examples of spanning capabilities are knowledge management systems and inter-organisational interpretation systems. Chen *et al.* (2019, p. 188) encourage researchers 'to theorise about the evolutionary nature of digital artefacts during the process of their diffusion and particularly internationalisation'. Based on the above arguments, this study posits three types of relationship between technological capabilities and different dimensions of AC. We propose these propositions:

Proposition 5a: Outside-in capabilities positively affect a firm's ability to acquire external knowledge.

Proposition 5b: Inside-out capabilities positively affect a firm's ability to apply valuable external knowledge commercially.

Proposition 5c: Spanning technological capabilities negatively influence a firm's ability to assimilate and transform valuable external knowledge.

3.2.5 Environmental Conditions

Zahra and George's (2002) reconceptualisation of AC as a dynamic capability opens new avenues for investigating different environmental conditions in which ambidextrous organisations build their AC and improve their competitive advantage. Teece (2016) recommends that managers need to acquire essential resources and stay abreast of critical trends that support development of organisational capabilities to address environmental changes. The role of dynamic capabilities is established for gaining competitive advantage. Strategic thinking facilitates the ability of managers to comprehend the capability development needed to deal with environmental changes (Teece, 2016). Managers' strategic thinking is one of the important determinants (Gross, 2017). Research has found that AC plays an important role in addressing environmental uncertainties (Cosaert *et al.*, 2018).

With this view of AC, understanding environmental contingency factors and their influence on competitive advantage becomes prudent. Zahra and George's (2002) reconceptualization does not include industry and environmental conditions, which initially were included by Cohen and Levinthal (1989, 1990). Cohen and Levinthal (1989, 1990) consider several exogenous factors (technological opportunities, industry demand, knowledge appropriability) and moderators (competitiveness, price elasticity, ease of external knowledge learning) that affect the willingness of firms to invest in AC.

In their seminal study of market orientation, Jaworski and Kohli (1993) note that firms facing a high degree of market turbulence have to improve their products and services very often to cater to customers' changing needs and satisfaction. Additionally, firms that face a high competitive intensity in their industry are likely to lose their customers if they are not market-oriented. Therefore, Jaworski and Kohli (1993) hypothesised a significant moderating effect of market turbulence on competitive intensity. They further argue that firms operating in an environment where technology rapidly changes, and old technology quickly becomes obsolete can gain competitive advantage through technological innovation but not through market orientation. Therefore, they hypothesise a weaker relationship between orientation and performance in a technologically turbulent environment. Finally, they find that environmental conditions significantly and positively affect the linkage between orientation and performance. Recently, scholars affirm that AC plays an important role in addressing environmental uncertainties (Zahra and George, 2002; Cosaert *et al.*, 2018; Distel, 2019).

Table 4 appears here

Lichtenthaler (2009) emphasises the importance of dynamic capability (AC) in situations characterised by high market and technological turbulence levels. He adopts the sequential three-step processes of AC: exploratory, transformative, and exploitative learning processes. Lichtenthaler tests the moderating effects of market and technological turbulence on the effectiveness of each process in terms of a firm's performance and innovation. However, Lichtenthaler did not find a significant impact of environmental moderators on the outcomes of AC. The strategic thinking of managers enables them to identify that information coming from the external environment could improve the firm's existing knowledge base. Second, to link the new information with existing knowledge (Todorova and Durisin, 2007).

Based on the discussion above emphasising their relevance and importance, our study considers environmental turbulence and competitiveness turbulence as the two moderators influencing the effectiveness of AC. Market turbulence and technological turbulence is considered Environmental turbulence. This study suggests exploring the moderating role of environmental turbulence on the effectiveness of PAC and RAC on competitiveness. We propose the following:

Proposition 6a: Market turbulence negatively moderates the influence of PAC (acquisition and assimilation) and RAC (transformation and exploitation) on competitive advantage.

Proposition 6b: Technological turbulence positively moderates the influence of PAC (acquisition and assimilation) and RAC (transformation and exploitation) on competitive advantage.

Matusik and Hill (1998) refer to environmental competitiveness as the degree to which a firm's environment is characterised by intense competition. Miller (1987) provided a more specific definition of competitiveness as the level of competition reflected by (a) the number of competitors and (b) the number of areas in which competition occurs. Hence we posit this proposition:

Proposition 7: Environmental competitiveness positively moderates the influence of PAC (acquisition and assimilation) and RAC (transformation and exploitation) on competitive advantage.

3.2.6 Internationalisation Process

Vahlne and Johanson (2017) recognise that business exchange instead of production has transformed the business landscape, with the network of actors presenting firms' answer to discontinuous changes. Characterising response to change, they recognise practical and

entrepreneurial behaviour as a substitute for a passive stance. Research identifies firms like 3M that possess the required resources and characteristics to successfully capitalise value from externally acquired knowledge, while several firms fail (Foss *et al.*, 2011; Lewin *et al.*, 2011).

Coviello *et al.*, (2017) highlight the significance of identifying processes that interpret how a firm adjusts to discontinuous technological change characteristics. Interestingly, although Vahlne and Johanson (2017, p. 8) state that "what happens in a firm happens in relationships", they do not eschew the existence of markets. Rather, they confirm that 'firms expand predominantly in markets similar–or adjacent–to the home market'. However, they limit their discussion to the firm and market context, while operational and strategic behaviours occur within respective business relationship networks. The digital context aligns with it, but Coviello *et al.* (2017) argue for recognising the importance of consumption democratisation and firms' ability to access the external productive capabilities facilitated by markets for a numerous range of different exchanges. There are growing numbers of participants with few active on both sides of the market. Knowledge development and the processes driving change affect a variety of participants, performing numerous roles both outside and within the firm. They are interrelated through various conduits, which can be managerial, physical interactions, and technological.

The evolving environment has changed how a firm is viewed; hence it is essential to see 'exchange being the critical activity' (Vahlne, 2020, p. 243). The firm needs to be seen as embedded in a larger multidimensional ecosystem. The ecosystem provides different knowledge and learning conduits (Bhatti *et al.*, 2020) wherein lie the opportunities to grow in existing or new relationships (Vahlne and Bhatti, 2019). Though the importance of external resources in internationalisation is well recognised (Coviello, 2006), knowledge user's value co-creation role in the ecosystem requires further exploration (Chen *et al.*, 2019). Therefore, we propose the following:

Proposition 8: The digital platform enabled the internationalisation process to positively moderates the influence of PAC (acquisition and assimilation) and RAC (transformation and exploitation) on competitive advantage.

4. Conclusions and Implications

The research on AC is burgeoning. Still, there is a clear need for exploration presenting a holistic view on ensuring successful creation, maintenance, and enhancement of AC. Benefits from AC can't be reaped in isolation. To sum up our study initially reviews AC based on the original work of Cohen and Levinthal (1989, 1990, and 1994). Zahra and George (2002) argued that firms' AC, being a dynamic capability, is the primary source of competitive advantage. They open the black box of long-term competitive advantage by extending Eisenhardt and Martin's (2000) research. Eisenhardt and Martin (2000) emphasised the importance of dynamic capabilities that facilitate organisations' reconfiguring of their resources according to differing environmental conditions to achieve sustainable competitive advantage. Revisiting this literature helps us to explore the role of different organisational and environmental conditions in creating and sustaining competitive advantage. We extend the insight into the exploration of AC as a 'dynamic capability' based on Zahra and George's (2002) work and add environmental conditions and the internationalisation process to the framework (see figure 2).

Our study contributes to the existing AC literature in three ways. First, we propose a conceptualisation that extends existing knowledge by creating two types of linkages. We identify the links among antecedents, multi-dimensions of AC, and competitive advantage. Antecedents include prior related knowledge and a firm's combinative and information technology capabilities. Multi-dimensions are Potential AC and Realised AC that are the main constructs in the framework. Potential AC is divided into acquisition and assimilation of external knowledge, whereas realised AC is divided into transformation and exploitation of knowledge. Competitive advantage is the outcome variable. The purpose of such amalgamation is to provide a holistic view for managers and practitioners to successfully develop, maintain, and enhance a firm's ability of AC.

The study's other main contribution is integrating the concept of AC into the Information Systems (IS) field by combining digitisation and organisational capabilities. Digitalisation has changed how business was traditionally carried out. Knowledge development and internationalisation processes drive change affecting actors on both outsides and within the firm. It combines a firm's technological capabilities with organisational capabilities and prior knowledge. The cognitive structures and mental models of individuals are error-prone, which may hinder the development and enhancement of AC. In such a situation, a firm's technological capabilities help it avoid errors by facilitating communication

among members and providing computational ease. As a result, such capabilities are likely to improve the firm's ability of PAC and RAC. These interactions are interrelated through various conduits, which can be managerial, physical, and technological. Due to technological turbulence, digital technologies are diffusing and converging rapidly. Therefore, it is crucial to understand the interactional role of environmental conditions and the internationalisation process and their influence on firms. The study establishes the moderating effect of environmental conditions and the internationalisation process on the effectiveness of PAC and RAC. The two moderators consist of a) environmental conditions, including market turbulence, technological turbulence, and competitiveness, and b) the internationalisation process.

Theoretical Implications

Our study advances the absorptive capacity conceptualization by exploring the interactional influences. More specifically, we advance the existing theory by conceptualizing how environmental conditions (market turbulence, technological turbulence, and competitiveness) and the internationalization process interplay between AC and competitive advantage. Our analysis of the extant literature highlights the interactional role of environmental conditions to nurture firms' AC. Recent theoretical and empirical literature calls for contributions which focus on exploring strategy formation and role of individuals engaged in decision making. Hence our study builds on those interacting individuals to uncover any causal agents by going below the firm level and contribute the this literature strand (see for comparison, Dahlander *et al.*, 2021; Crupi *et al.*, 2020; Contractor *et al.* 2019; Ter Wal *et al.*, 2017).

Moreover, the proposed framework contributes by bridging the gap in the micro-foundation-based limitations highlighted by Roberts *et al.* (2012); Barney and Felin, (2013); Felin, Foss, and Ployhart, (2015); Coviello *et al.* (2017); Yao and Chang (2017); and Chen *et al.* (2019). Rapid knowledge dissipation and convergence meaningfully facilitate AC development and maintenance. Firms combine technology-focused investments with complementary assets to create digital capabilities, which enhances AC (Gold *et al.*, 2001). It is established that the synergetic influence of digitisation and peripheral capabilities influence AC. It is also recognised that the micro-level characteristics and actions of individuals are tightly intertwined with firm-level outcomes. Ultimately, the interacting individual connects the organisation and the environment they operate in and enables the transformation of potential opportunities into outcomes.

Practical Implications of Study

Overall, our conceptualisation contains various insights and crucial activities for individuals contributing to organisational AC endeavours. The insights from figure 1 may hence contribute to increased proficiency of individuals to absorb knowledge in the AC processes. In addition, our conceptualisation provides useful managerial implications. Managers can spur AC processes and outcomes by adopting actions and responses that facilitate individual contributions to AC. For example, the preconditions for action can be addressed by modifying working conditions, such as providing employees ample slack time to explore new knowledge and expand their existing knowledge base.

Also, managers can identify key individuals in research and development and make sure they have the required business and/or technical knowledge by offering on-the-job training and education programs. This may involve interdepartmental exchange programs or job-rotation initiatives involving, for example, service support units, marketing, and sales. This empowers employees with the organisational knowledge required to exhibit business value. Although not all individuals can facilitate internal knowledge absorption, the solution can encourage employees to find roles or positions wherein their skills are aligned or where they experience their work to be more meaningful.

In any case, it is not always desirable, either for individuals or their organisations, to absorb more external knowledge. Organisational barriers along with the AC process can help remove or keep out bad ideas, limit the processing of excessive knowledge, prohibit the progression of low-grade project proposals, and promote effective utilisation of resources and capabilities. This does not imply that all challenges should be removed but instead, a better understanding of different activities, barriers, characteristics, and enablers should be developed. Hence organisations can facilitate the AC processes by allowing smoother conduits for individual contributions.

Limitations and Future Research Avenues

As this study is a conceptual one, the study suffers from a few limitations. The first limitation is that it does not capture the synergetic effect of IT and other organisational capabilities. Investing in IT resources alone is not sufficient to enhance the benefits of AC. Roberts *et al.* (2012) emphasise the combined effect of IT and complementary organisational capabilities on

AC. Future studies may extend the existing framework by including synergies among different antecedents. Specifically, the synergy between IT and combinative capabilities will facilitate the creation of digital capability. So a new avenue for progressive researchers is to explore AC as a digital capability. Furthermore, this is a conceptual study which has some inherent limitations in terms of practical implications. Future research may attempt to test the propositions empirically to enhance the practical implications.

Second, this study posits that all three environmental conditions positively moderate the effectiveness of PAC and RAC. However, this may not always be the case. Jansen *et al.* (2005) examine differing effects of dynamism and competitiveness on the effectiveness of exploratory innovation and exploitative innovation. Future studies may practically test the suggested relationships and confirm the results. Another contribution opportunity can be the empirical analysis of the model to confirm all suggested linkages. As the creation of a firm's AC is path-dependent, the successful creation and absorption of new knowledge can influence the firm's future ability of AC. With this remark we would like to point out there is a need to empirical test and document the differential moderating effect of three environmental conditions.

The ultimate objective of any firm is always to gain a sustainable advantage over competitors. Undoubtedly, AC enhances a firm's ability to gain a competitive advantage in today's intensely demanding business environment. Environmental fluctuations result in time-to-market pressures, changing customer preferences, shorter product life cycles, rapid technology convergence, and product proliferation. In such contextual conditions, progressive firms are becoming ambidextrous. Our study provides firms a roadmap for successful investments in risky and costly research and innovation projects. The roadmap will simplify the process of creating absorptive capacities to develop new products or services according to customers' changing preferences.

Due to technological breakthroughs, firms face a cognitive burden to enhance the ability to identify, assimilate, and mobilise valuable knowledge related to developing new processes and products according to industry demands. Combining IT resources and other organisational mechanisms associated with coordination, systems, and socialisation capabilities can reduce this burden. All organisational capabilities and firms' existing knowledge base assets facilitate the creation of AC and improve a firm's innovation, strategic flexibility, and overall performance in fierce business competition. In the end, a measured AC is indicative of firms'

intensity levels and the structured efforts that they apply within. Also, it is a subtle depiction of absorptive capacity influence on their performance. Nevertheless, it is growingly apparent that firms must consistently innovate to sustain their competitive edge.

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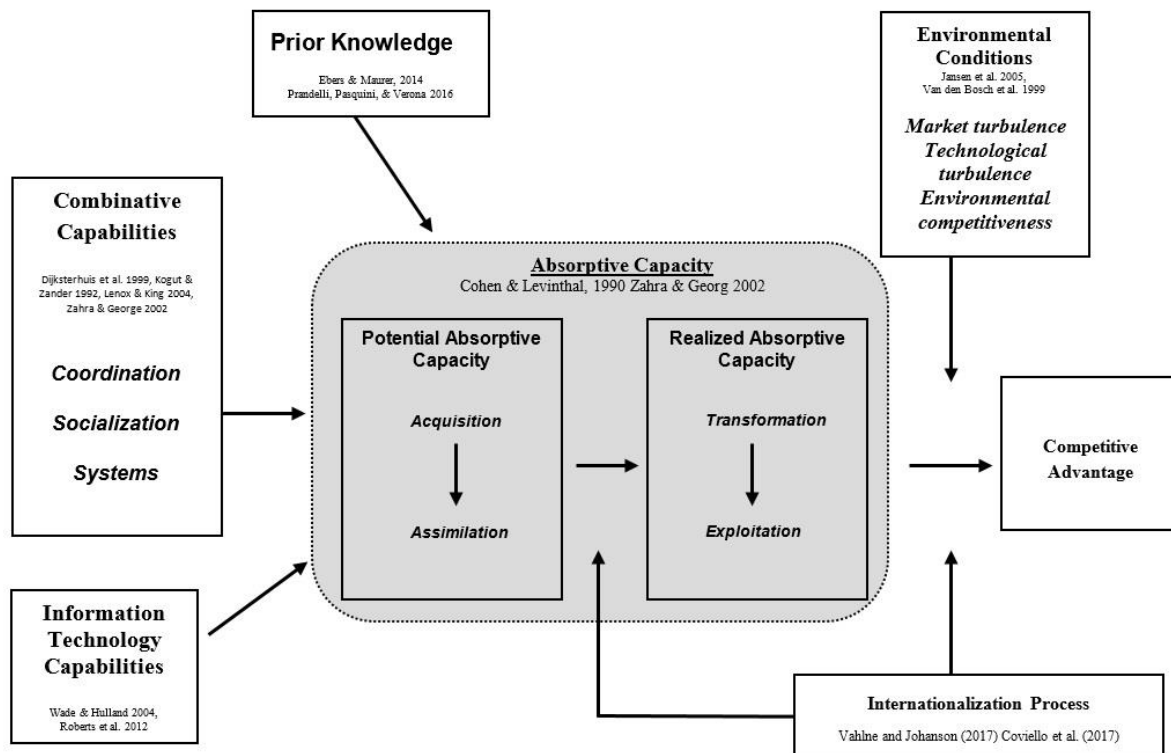


Figure 1
 An Integrative Framework of Absorptive Capacity

Relationships	Results
Scope of technological opportunities → R&D spending	Positive
Knowledge appropriability → R&D spending	Positive
Industry Demand → R&D spending	Positive
Ease of learning external knowledge * Opportunities → R&D spending	Positive
Ease of learning external knowledge * Appropriability → R&D spending	Positive
Price Elasticity * Appropriability → R&D spending	Negative
Competitiveness * Appropriability → R&D spending	Positive
R&D Spending → Absorptive Capacity	Positive

Table 1: Relationships of Theoretical Model by Cohen and Levinthal (1989, 1990, 1994)

Studies	APCP Dimensions	Model Description		
		Antecedents/ Drivers	Contingency Factors	Consequences
Zahra and George (2002)	Potential APCP: Acquisition, Assimilation Realised APCP: Transformation, Exploitation	Knowledge Source, Prior Knowledge	Activation Triggers, Social Integration Mechanisms, Regimes of Appropriability	Competitive Advantage: Strategic Flexibility, Innovation, Performance
Lane <i>et al.</i> (2006)	Exploratory Learning (recognise and understand new knowledge), Transformative Learning (assimilation), Exploitative Learning (utilisation)	Internal Drivers: Structures and Processes, Individual Cognition, Strategies External Drivers: Characteristics of Knowledge, Learning Relationships, Environmental Conditions		Knowledge Outputs (general, scientific, technical, organisational), Commercial Outputs (products/ services, intellectual property rights), Firm Performance
Todorova and Durisin (2007)	Valuation, Acquisition, Assimilation, Transformation, Exploitation	Knowledge Source, Prior Knowledge	Power Relationships, Activation Triggers, Social Integration Mechanisms, Regimes of Appropriability	Competitive Advantage: Strategic Flexibility, Innovation, Performance
Park and Harris (2014)	Micro-foundations— at individual-, process-, and structural levels,	Prior Knowledge, Experience of individuals, And Managers' Educational level	The linkages between three level—are crucial in AC building	Copying, recruitment and searching, Experiential learning
Martinkenaite and Breunig (2016)	Horizontal and Vertical Dimensions	Interplay between internal and external environments, Individual-Organisation interactions		Organisational learning capability
Ter Wal <i>et al.</i> (2017)	Unfolding of individual knowledge process	Individual AC efforts		Knowledge application through engagement
Distel (2019)	Formal and Informal integration mechanisms		Motivated cognition and Creative behavior	Microfoundations of absorptive capacity

Table 2: Absorptive Studies and Their Descriptions

Antecedents	Dimensions	Prior Researches
Prior Related Knowledge		Cohen and Levinthal (1989, 1990); Grant (1996); Kim (1997); Van den Bosch <i>et al.</i> (1999); Zahra and George (2002); Lane <i>et al.</i> , (2006); Todorova and Durisin (2007); Roberts <i>et al.</i> , (2012); Kotabe <i>et al.</i> , 2017; Cosaert <i>et al.</i> , 2018; Distel, 2019.
Coordination Capabilities	Cross-functional interfaces, participation, job rotation	Galbraith (1973); Daft and Langel (1986); Cohen and Levinthal (1990); Van den Bosch (1999); Jansen <i>et al.</i> (2005); Jansen <i>et al.</i> (2006); Roberts <i>et al.</i> (2012); Kim <i>et al.</i> , (2014); Engelman <i>et al.</i> , 2017).
Socialisation Capabilities	Connectedness, socialisation tactics	Camerer and Vepsalainen (1988); Nahapiet and Ghoshal (1998); Van den Bosch <i>et al.</i> (1999); Zahra and George (2002); Jansen <i>et al.</i> (2006); Todorova and Durisin (2007); Roberts <i>et al.</i> (2012); Flatten <i>et al.</i> , (2015); Gross, (2017); Distel, (2019).
Systems Capabilities	Formalisation, routinisation	Weick (1979); Cohen and Bacdayan (1994); Galunic and Rodan (1998); Adler <i>et al.</i> (1999); Van den Bosch (1999); Zollo and Winter (2002); Jansen <i>et al.</i> (2006); Kim <i>et al.</i> , (2014); Adams <i>et al.</i> , (2016); Gross, (2017).
IT Capabilities	Outside-in, spanning, inside-out	Gold <i>et al.</i> (2001); Bharadwaj <i>et al.</i> , (2007); Roberts <i>et al.</i> (2012); Brouthers, <i>et al.</i> , (2016); Strange and Zucchella, (2017); Chen, <i>et al.</i> , (2019).

Table 3: Antecedents of Absorptive Capacity and Prior Related Studies

Prior Researches	Influence of Environmental Conditions
Cohen and Levinthal (1989, 1990)	Technological opportunities, industry conditions, and competitiveness on R&D investments
Jaworski and Kohli (1993)	Market turbulence, technological turbulence, and competitive intensity on the effectiveness of market orientation
Van den Bosch <i>et al.</i> (1999)	Stable external knowledge environments and turbulent knowledge environments on the relationship between determinants (organisational forms and combinative capabilities) and absorptive capacity
Jansen <i>et al.</i> (2006)	Environmental dynamism and environmental competitiveness on exploratory and exploitative innovation
Lane <i>et al.</i> , (2006)	Environmental aspects (knowledge environment, competitive environment, regulatory environment) on absorptive capacity three step process
Lichtenthaler (2009)	Market turbulence and technological turbulence on the effectiveness of exploratory, transformative, and exploitative learning
Criscuolo, Salter, and Ter Wal, (2013)	Individual efforts to secure resources exploiting external knowledge using internal strings and even involving illicit behaviors such as bootlegging
Martinkenaite and Breunig (2016)	Interplay between internal and external environments

Table 4: Environmental Conditions and Antecedents

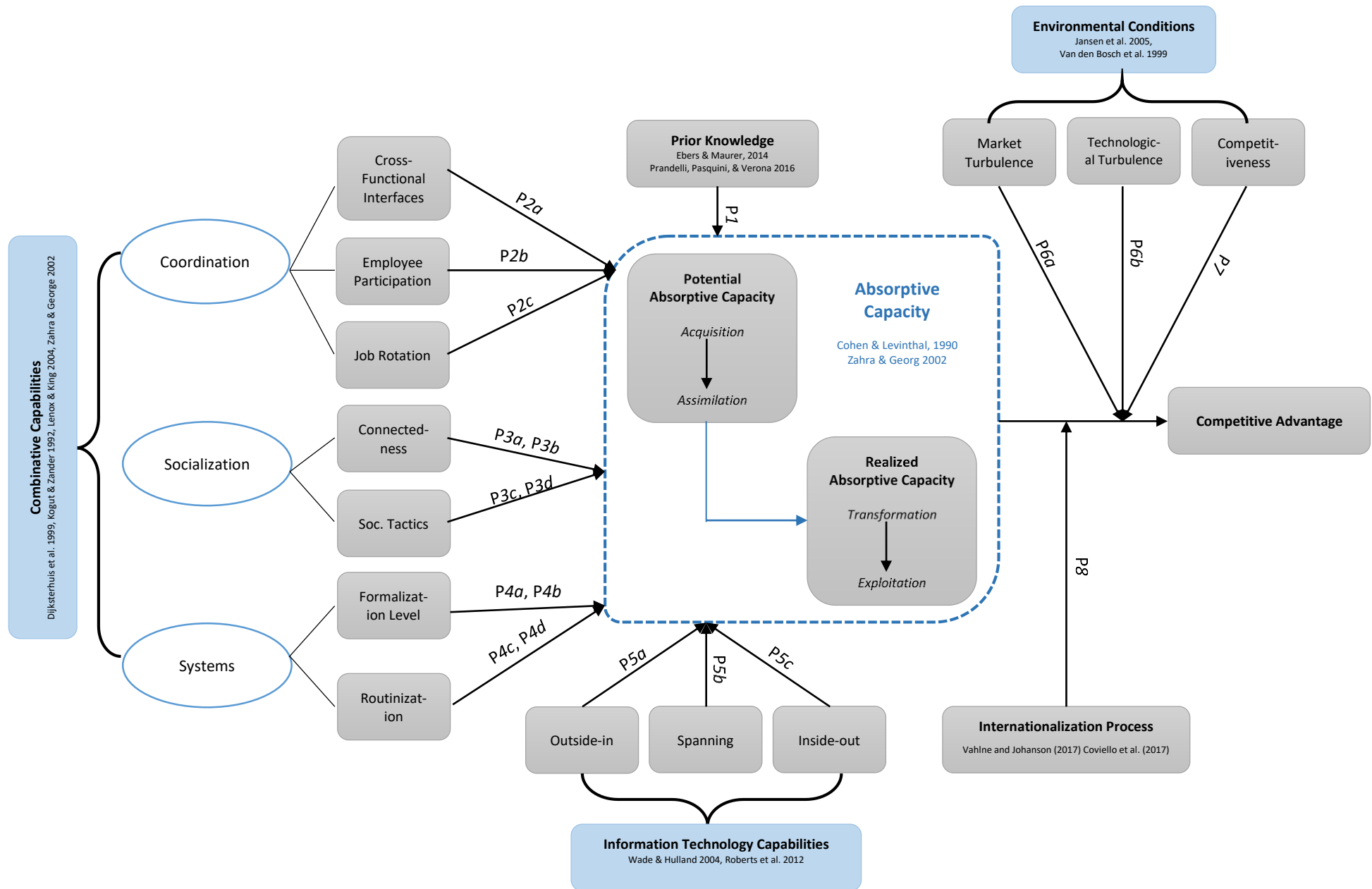


Figure 2: The Absorptive Capacity Integrative Framework