



Bibliometric analysis of absorptive capacity



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ABSTRACT

This study contributes to our understanding of absorptive capacity (AC) by reviewing AC articles systematically using two types of bibliometric co-citation analysis – bibliometric co-citation and bibliometric cartography – for the last 25 years. In total, we analyzed 336 articles (using *HistCite*) and 2088 articles (using *VOSviewer*), respectively, finding five research streams in AC: (1) intra-organizational learning; (2) inter-organizational learning; (3) knowledge transfer; (4) dynamic capability; and (5) micro-foundations. This integrative literature review of AC adds to the categorization of the literature, links the international business research to AC, and provides promising future research directions. Our study gives detailed information about the development of each research stream by measuring the number of publications in each stream over 25 years using bibliometric cartography analysis. Based on the literature, we propose 26 future research questions for these five research streams.

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1. Introduction

In 1990, Cohen and Levinthal wrote a seminal paper introducing the construct of absorptive capacity (AC), defined as “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends” (Cohen & Levinthal, 1990, p. 128). In the past 25 years, the number of articles applying, measuring, operationalizing, and re-conceptualizing AC has increased rapidly, reflecting the richness of this new construct in research fields, which led to the writing of bibliometric analysis of AC. He, Zhang, and Wang (2015), Minbaeva, Pedersen, Björkman, Fey, and Park (2014), Fagerberg and Srholec (2008) and Jansen, Volberda, and Van Den Bosch (2005) argued it is crucial to analyze the multifaceted dimensions of AC as a complex and strategic construct. As a construct, AC has been inserted in multiple and diverse theoretical frameworks (discussed briefly in the next section).

To capture the richness of the AC construct, we employ bibliometric co-citation analysis. Bibliometric co-citation analysis is a type of meta-analytical tool with analytical properties (Cote, Leong, & Cote, 1991; Kim & McMillan, 2008). Bibliometric co-citation analysis demonstrates interconnections amongst articles and research topics by analyzing how often an article is cited and

co-cited by other articles, indicating a key research stream (Luukkonen, 1997; Nederhof, 2006).

Lane, Koka, and Pathak (2006) and Volberda, Foss, and Lyles (2010) conducted bibliometric analysis on AC. However, given the recent growth in the AC literature, these studies do not sufficiently cover the latest development of the AC literature and its impact on international business (IB). We contribute to the literature of AC by performing two types of bibliometric analysis applied on a much expanded literature base. Lane et al. (2006) rely for their analysis on AC articles from 1990 to 2002, and Volberda et al. (2010) use AC articles from 1992 to 2005, while much of the growth of this literature happened since (see Fig. 1).

Our meta literature review is also methodologically different than the previous ones on the topic. Lane et al. (2006) developed research streams by summarizing 64 AC articles with two-to-three sentences and identifying their similarities in terms of topic, AC operationalization, and empirical and theoretical contributions. Volberda et al. (2010), in contrast, applied a keywords analysis to examine co-occurrences between words in 1213 AC articles, resulting in the selection of 83 keywords that form the basis for AC research stream construction. In our study, we use *HistCite* software to conduct a bibliometric analysis by assessing the networks amongst highly cited articles. *HistCite* provides timeline visualization of citations, pinpoints the most-cited articles, and indicates the subsequent impact of those citations (Garfield, 2009; Thelwall, 2008). *HistCite* has been widely used in various studies (Christensen & Gazley, 2008; Fetscherin & Heinrich, 2015). To our knowledge, *HistCite* bibliometric analysis has not been used on the

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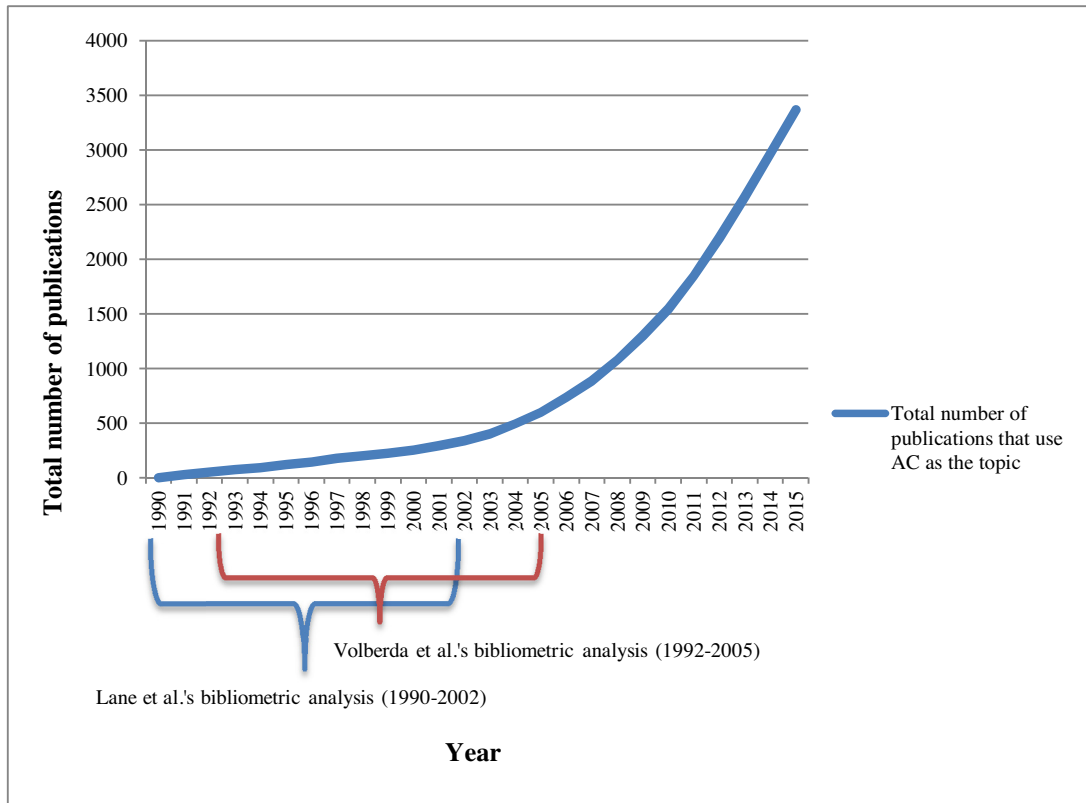


Fig. 1. Total Number of Absorptive Capacity (AC) Publications.

Source: ISI Web of Science.

AC construct previously. *HistCite* can analyze and demonstrate the citation amongst articles retrieved from the Web of Science. Genealogic antecedents of a research field are discovered through citation behavior, and publications that are heavily cited will be highlighted (Fetscherin, Voss, & Gugler, 2010, p. 6).

In addition, unlike the previous bibliometric analyses, our article gives information on which articles, journals, and countries contribute most to AC research. We supplement the *HistCite* bibliometric analysis with cartographic analysis. These help to

examine key words in various AC research streams. Beyond this, the analyses in this article measure the popularity of AC articles and identify different research streams of AC publications in the IB context. We narrowly focus on the impact that AC has had on the IB research and offer future research directions to the field.

AC contributes to IB as a major determinant of knowledge processes in the multinational context (Björkman, Stahl, & Vaara, 2007; Gupta & Govindarajan, 2000; Minbaeva, Pedersen, Björkman, Fey, & Park, 2003). AC analyses organizational change and the

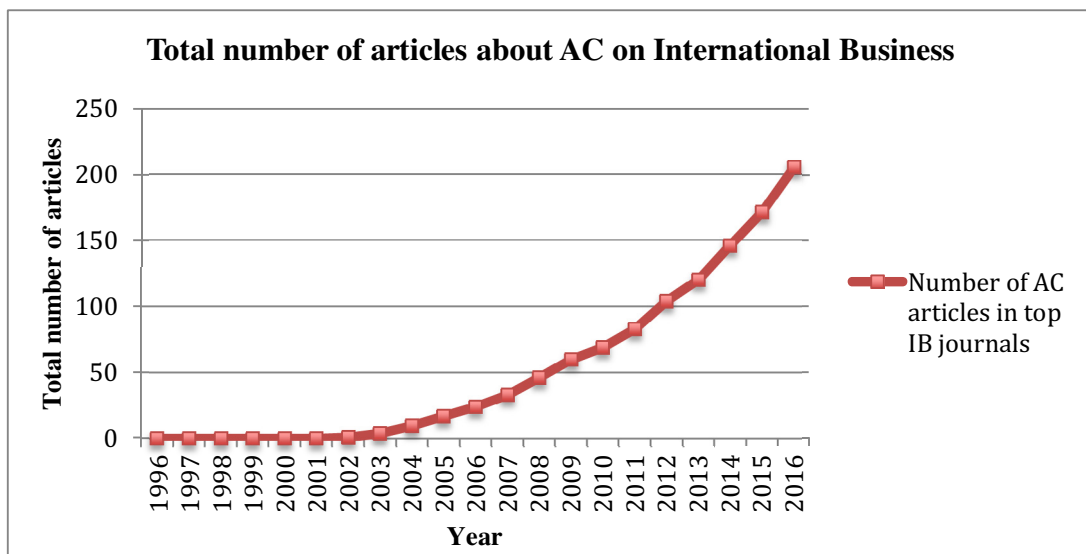


Fig. 2. Total Number of Absorptive Capacity (AC) Articles on International Business (IB) Top Journals.

Source: ISI Web of Science.

evolution of firms to adapt to changes in international environments (Chang, Chung, & Moon, 2013; Li & Kozhikode, 2008; Petersen, Pedersen, & Lyles, 2008; Wu & Voss, 2015; Wu, Wang, Hong, Piperopoulos, & Zhuo, 2016). IB scholars confirm the significance of AC in several contexts: multinational corporations (Frost & Zhou, 2005; Wang, Tong, & Koh, 2004), cross border mergers (Li, Li, & Wang, 2016), cross border buyer-suppliers (Liu, 2012), international joint ventures (IJV) (Anh, Baughn, Hang, & Neupert, 2006; Khan & Nicholson, 2014; Park and Harris, 2014), born global firms (Freeman, Hutchings, Lazaris, & Zyngier, 2010), and foreign versus local firms (Chang et al., 2013; Park & Ghauri, 2011). Fig. 2 shows the number of AC articles published in top IB journals: *Journal of International Business Studies*, *Journal of World Business*, *Management International Review*, and *International Business Review*.

Through bibliometric co-citation and cartography analysis, as well as content analysis of the literature, this article fills the research gap on AC meta-analysis review and answers the following questions:

1. How are AC articles clustered? What research streams emerge?
2. Which research streams receive the most attention in numbers of publications?
3. What are future AC research questions that provide opportunities to further the role of AC in IB field?
4. Which channels (journals, articles, and countries) are the most influential in AC research?

The rest of the article is organized as follows: the next section discusses the theoretical underpinning of AC, followed by the methodology section, results showing the emerging research clusters, a discussion, conclusion and recommendations for future research.

2. Theoretical multidimensionality of the absorptive capacity (AC) construct

The ability of AC to integrate with other theories promotes its diffusion. AC has been used in theories of organizational learning, social cognition, resource dependence, networks, knowledge, and dynamic capability. We discuss each one to provide an overview of the theoretical underpinnings.

According to organizational learning theory, it is crucial for a firm to identify, assimilate, and apply knowledge to value creation (Cohen & Levinthal, 1990; Todorova & Durisin, 2007). Organizations can transform individual learning into organizational learning (Hedberg, 1981; Kim, 1993) but this process needs to be supported by organizational mechanisms that allow the members to learn and solve problems (Slater and Narver, 1995). Overlapping technological capabilities as well as technological distance can enhance a firm's ability to absorb new knowledge and competencies from other firms (Mowery, Oxley, & Silverman, 1996; Nooteboom, Van Haverbeke, Duysters, Gilsing, & Van den Oord, 2007). Organizational learning theory is commonly used for internal learning discussions because it examines the history of a firm and explores how a firm adapts to dynamic environments to obtain a competitive advantage (Barney, 1991).

Social cognitive theory states that people are driven by the interactions of their behavior, cognition, and external environment (Bandura, 1986; Wood & Bandura, 1989). Through a cognitive process, the external environment can determine a person's behavior (Bandura, 1986). According to social cognitive theory, organization AC relies on its individual members' AC (Cohen & Levinthal, 1990), which is influenced by their cognitive structures (Volberda et al., 2010). Cognitive structure lead an individual to identify, choose, and process knowledge (Bandura, 2001) and

determine behavior and decision-making (De Carolis & Saporito, 2006; Hsu, Chen, & Cheng, 2013). Social cognitive theory is frequently linked to organizational performance and applied in internal knowledge sharing research (Wang & Noe, 2010).

The resource dependence theory states that the social context of an organization matters: organizations create strategies to reduce dependencies and increase autonomy and their level of power determines their internal and external actions (Davis & Cobb, 2010). The interrelation between resource dependence theory and AC builds on the argument that organizations establish relationship learning with other organizations to acquire more control and diminish external constraints (Pfeffer & Salancik, 1978; Selnes & Sallis, 2003). Inter-organizational relationships enhance a firm's dependency if the firm has the AC to recognize the value of external knowledge, absorb it, and exploit new knowledge (Cohen & Levinthal, 1990; Daghfous, 2004; Mowery et al., 1996; Veugelers, 1997). Resource dependence theory linked to knowledge processes is developed as a basis theory of inter-firm cooperation (Grant & Baden-Fuller, 2004). Grant and Baden-Fuller (2004) posit alliances can be seen as means for organizational learning because the motivation of alliances is driven by the will of firms to obtain knowledge from each other.

Network theory is used in inter-organizational relationship literature (Dhanaraj & Parkhe, 2006; Grandori and Soda, 1995; Kim, Oh, & Swaminathan, 2006) to explain how the relationship between firms can promote inter-organizational learning (Gulati, 1995). Gulati (1999) introduces the application of network resources in firm alliances, arguing that resources embedded in firm alliance networks, and the ability of firms to absorb resources, influences their value and how they behave. Further, in network theory, network size and diversity influence the level of AC (Zahra & George, 2002); network structure and position, along with AC, can determine firm innovation performance (Tsai, 2001). Network theory has been applied to inter-organizational research (Achrol & Kotler, 1999; Gulati, 1998) and has also been linked to organizational learning theory to analyze the capacity of an organization to absorb new knowledge and technology (Andersson, Forsgren, & Pedersen, 2001).

Knowledge-based theory relates to AC because interactions within or across organizations, and openness to external knowledge sources, are key elements for knowledge creation (Grant, 1996). Knowledge transfer relies on the AC of recipients (Cohen & Levinthal, 1990; Grant, 1996; Zahra & George, 2002). Therefore, a firm needs competent individuals because they have the ability to acquire, store, and process knowledge (Cohen & Levinthal, 1990; Grant, 1996). Knowledge-based theory provides a larger foundation upon which to develop intra- and inter-organizational learning theory (Grant, 1996).

Dynamic capability theory argues that the ability of firms to coordinate, build, and reconfigure internal and external resources or competencies is a strategy to cope with challenging environments (Eisenhardt & Martin, 2000). AC can increase a firm's dynamic capability because it encourages organizational learning (Mowery et al., 1996). AC itself has dynamic capability since it helps a firm achieve competitive advantage by continuously absorbing external knowledge, renewing its knowledge base, and exploiting new knowledge (Zahra & George, 2002). Teece, Pisano, and Shuen (1997) argue a firm possesses and accumulates beneficial knowledge when the firm has the ability to efficaciously coordinate and re-arrange resources internally and externally. Thus, this theory emphasizes the dynamic context of resource-based perspective by examining the internal responses to environmental changes (Wang, Klein, & Jiang, 2007; Winter, 2003).

The above review suggests that AC is a resilient and adaptive construct with the potential to impact multiple theories applicable to IB.

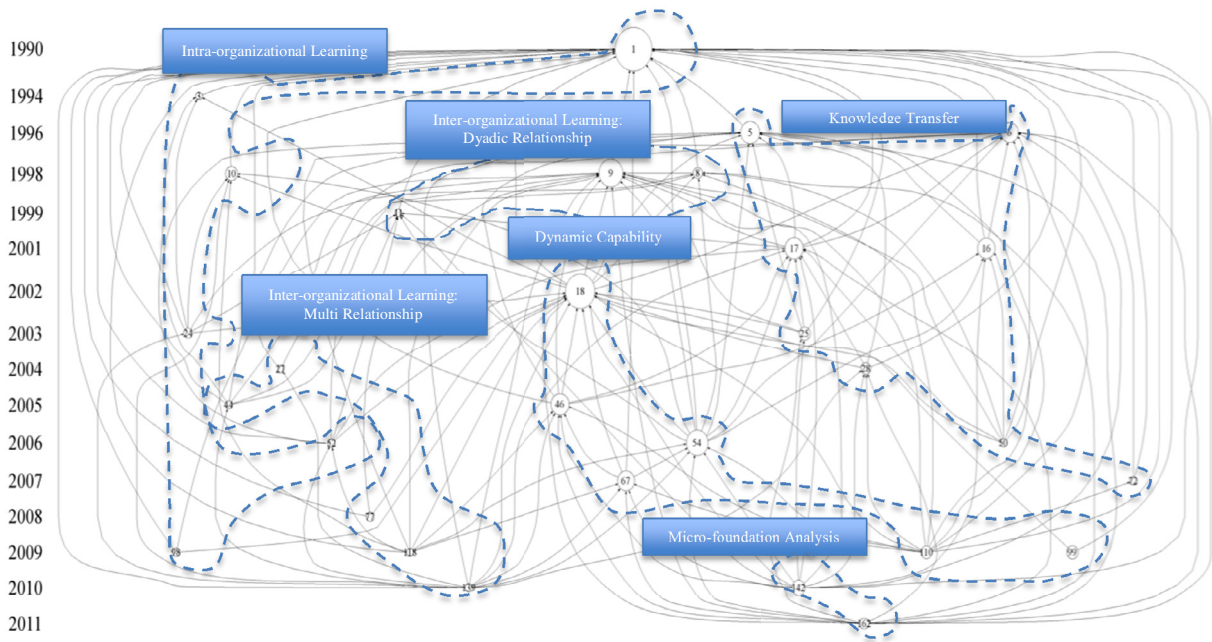


Fig. 3. Absorptive Capacity (AC) Citation Mapping.

3. Methods

This article utilizes quantitative and qualitative assessment of the literature. Quantitatively, we use two types of bibliometric analysis: bibliometric co-citation and cartography analysis. In addition, we content analyze the literature through readings of all the top *ISI Web of Science (ISI)* articles on AC and categorize them into streams.

In bibliometric analysis, we aim to demonstrate interconnections amongst articles and research topics by analyzing how often an article is cited and co-cited by other articles. The article is the basic unit of analysis. A basic assumption in bibliometric co-citation analysis is that published articles in scholarly journals build their research on similar articles already published (Van Raan, 2012). Bibliometric co-citation meta-analysis can help to reveal underlying commonalities among AC research. By measuring the citations pattern amongst articles, we can identify key research streams.

The chosen bibliometric tool *HistCite* is a robust quantitative methods improving on conventional literature reviews (Zupic & Čater, 2015). *HistCite* informs about important articles, authors, institutions, countries, and journal publishers, yielding a deeper and more reliable map of AC research streams compared to prior studies.

We use two types of data to apply two quantitative method tools: bibliometric co-citation and cartography analysis. To form the database, our study uses publication data on AC from the *ISI* for articles from 1990 to 2015. *ISI* has been used as a key database of top journals in previous studies (Fetscherin & Heinrich, 2015). The starting year is 1990, when Cohen and Levinthal introduced AC. We use two approaches to select the AC articles. First, we select articles that have cited Cohen and Levinthal (1990), and, second, following De Bakker et al. (2005), only those which include AC in their title, abstract, or keywords. The resulting database of 336 articles was carefully read and content analyzed.

In addition to *HistCite* bibliometric analysis, we also utilized bibliometric cartography analysis. This is a tool designed to analyze keywords. Keywords analysis is used to identify the growth of each AC research stream through the number of publications in the past

25 years (Ding, Chowdhury, & Foo, 2001). Bibliometric cartography analysis enables us to determine which research stream is under-studied by identifying areas with fewest articles (Volberda et al., 2010).

In the bibliometric cartography analysis, we identified all publications from *ISI* that use AC as a key word (in abstract or keyword data fields); from 1990 to 2015; and found 2088 articles. By using *VOSviewer*; we can select the 99 most frequently occurring keywords; with 10 or more occurrences. *VOSviewer* can classify those keywords into different clusters: those located near each other depict a high frequency of co-occurrences in articles; and those further apart demonstrate low co-occurrence frequency. Each keyword cluster represents a research stream in AC. Using these keywords; we calculated co-occurrences in 2088 articles; following Volberda et al. (2010); to identify the growth in each research stream. In bibliometric cartography analysis; one does not apply such strict rules of selection to provide high latitude of variability.

In our more traditional literature review (qualitative method), we collected recent AC articles in the IB field that were published in the top journals.¹ We identified their current research, analyzed their various research questions, and evaluated their future research questions. This procedure gave context to the more quantitative methods employed, and more richness to our discussion.

4. Findings

4.1. Citation mapping: the research streams on absorptive capacity (AC)

Co-citation mapping techniques depict how articles on AC are cited and co-cited concurrently over time, which allows this article to map out research streams and analyze the source and direction

¹ Particularly International Business Review, Journal of Business Studies, Journal of World Business, Strategic Management Journal, Academy of Management Review, Technovation, and Asia Pacific Journal of Management.

of future research, as suggested by Small (1999). In order to have parsimonious and meaningful results and identify co-citation networks among the 336 articles, Fig. 3 was limited to articles cited at least 11 times since 1990, resulting in 30 articles as the most-cited ones. If we use too few citations, it is difficult to make sense of the figure; but, if we use too many citations, depth is sacrificed. HistCite also analyses interrelations among 30 articles through their citation and co-citation patterns. The number of articles we selected is relatively similar with the number of articles used by Cuccurullo, Aria, and Sarto (2016), Fetscherin and Heinrich (2015), and Garfield, Pudovkin, and Istomin (2003). The articles shown in the citation mapping, representing only about 9 percent of the 336 articles in our database, were the most influential.

In Fig. 3, the vertical axis denotes the year of publication. Each node represents an article, while the size of the node circle represents how influential the articles are in terms of the number of total local citations. An arrow represents the citation relationship among the articles. Through HistCite we identified five research streams, as illustrated in Fig. 3. Nodes that are closer to each other represent similarities compared to nodes that are far apart.

A content analysis of the articles suggests that there are five research streams which can be categorized into 1) intra-organizational learning (6 articles); 2) inter-organizational learning (8 articles): a) dyadic inter-organizational relationship (3 articles) and b) multiple inter-organizational relationship (5 articles); 3) knowledge transfer (8 articles); 4) dynamic capability (6 articles) and; 5) micro-foundations (2 articles). Each stream consisted of distinct but interrelated cluster of articles. The articles grouped into one cluster based on the similarity of their topics, the unit of analysis and/or context. We labeled the clusters by investigating the content of those articles. There are also overlapped research streams, but the categorization shown in citation mapping helps to link related articles to a specific root. By using bibliometric co-citation analysis, we ensure the clusters are internally consistent and externally exclusive so we can minimize the overlap. A short discussion of each stream follows.

4.1.1. Intra-organizational learning

A major question in this research stream asks how a firm can learn, capture, and exploit the value of external knowledge. Cohen and Levinthal (1990) (1 in Fig. 4) first coined the term AC. They mention a variety of antecedents that influence AC at the organizational level, including routines, management practices, and individual AC. In 1998, Kim (1998) (10 in Fig. 4) discussed the knowledge process of an emerging market firm that attempts to “catch up” or to move from imitation to innovation. Kim cites the example of an organization that treats crises in a competitive international market as an opportunity to learn, forcing an increase in technological effort and innovation. AC itself is the ability of firms to learn, which allows them to assimilate and create knowledge.

Liao, Welsch, and Stoica (2003) (24 in Fig. 4) elaborated on the contextual factors of AC, stating that an organization should respond to market changes proactively by integrating existing and new knowledge in order to cope with market turbulence effectively. Liao et al.’s article suggests that firms facing intense competition in domestic and foreign markets are forced to be responsive to changes, and AC facilitates the responsiveness. This research stream suggests that relationships across individuals and intra-organizational factors contribute to a knowledge building process that affect how firms learn. IB research increasingly focuses on the interaction between firms, their internal knowledge processes, and their environments (Andersson, Dasí, Mudambi, & Pedersen, 2016).

In intra-organizational learning, the future research questions extend from how the different levels of knowledge between

receiver and receiving entities affect internal learning (Easterby-Smith et al., 2008; Minbaeva, Pedersen, Björkman, & Fey, 2013), what absorption strategies need to be applied by multinational subsidiaries to develop AC (Schleimer & Pedersen, 2014), what the long-term benefits of new knowledge are and how such knowledge is utilized in small born-global firms (Freeman et al., 2010), to what extent past innovation activities influence firms’ knowledge search and their willingness to invest in internal R&D (Love, Roper, & Vahter, 2014), and what the implications of the different knowledge types to AC development are (Fang, Wade, Delios, & Beamish, 2013).

4.1.2. Inter-organizational learning

The dominant research question in inter-organizational learning investigates the role of AC in helping firms find prospective partners to learn from. This research stream suggests that competitive advantage emanates from environmental learning and divides into two sub-streams: learning in dyadic and multi-relationships.

In dyadic inter-organizational relationships, Koza and Lewin (1998) (8 in Fig. 4) published a theoretical analysis study on the role of AC in helping a firm form an alliance. In the same year, Lane and Lubatkin (1998) (9 in Fig. 4) showed that the decision of a “student” firm to select a “parent” firm in strategic alliances depends on the degree of relative AC between the “student” and “teacher” firm. Relative AC has three aspects: the knowledge base, the pay and benefit system, and the organization structures. A year later, Shenkar and Li (1999) (11 in Fig. 4) explained that the knowledge-seeking behavior of firms in international joint ventures to find prospective partner firms relies on their AC. Firms search for a partner with complementary knowledge, or firms that can expand their existing knowledge.

In multiple inter-organizational relationships, Caloghirou, Kastelli, and Tsakanikas (2004) (27 in Fig. 4) found that firms can increase their innovation performance if they can acquire external knowledge from their broad networks, if the firms have sufficient AC. Their study indicates that open communication between firms and other knowledge-exchange entities lets firms establish networks with embedded knowledge. Interaction between firms and their networks allows them to articulate and codify knowledge, which contributes to a firm’s long-term knowledge development.

Chen, Lin, and Chang (2009) (98 in Fig. 4) explored how relationship learning, or *guanxi* in the Chinese context, builds trust between partners for information exchange. Chen et al.’s article discusses the value of relational ties in knowledge exchange. Zahra and Hayton (2008) (77 in Fig. 4) and Murovec and Prodan (2009) (118 in Fig. 4) argued that the ability of firms in international ventures to grow and survive depends on their AC. The ability of firms to acquire, assimilate, and apply knowledge from their markets depends on the development of their internal R&D.

In inter-organizational learning, the future research questions center on the influence of organizational change on internal knowledge processes and knowledge searches (Schleimer and Pedersen, 2014), the level of knowledge base required by a firm to learn new external knowledge, which capability is most needed by firms to absorb the knowledge (Zhou & Li, 2012), and whether networks affect firms’ strategies on external knowledge searches and learning as well as on AC development (Ferreras-Méndez, Fernández-Mesa, & Alegre, 2016).

4.1.3. Knowledge transfer

The research questions in the knowledge transfer stream ask what the requirements and the role of AC are in the intra- and inter-knowledge transfer process. What are the contextual factors that affect the process? Szulanski (1996) (5 in Fig. 4) investigated

factors that can hinder knowledge transfer between units in a firm: characteristics of knowledge, context, and receiver level. The level of the AC receiver determines a firm's stickiness, which serves as a primary condition for knowledge transfer.

Mowery et al. (1996) (6 in Fig. 4) suggested that the effectiveness of strategic alliances depends on the degree of the firms' AC and how they obtain technological capabilities through agreements and knowledge absorption from each other. In contrast, cultural differences and physical distance are obstacles in knowledge transfer. Lane, Salk, and Lyles (2001) (17 in Fig. 4) stated that relative AC can be measured by: 1) compatibility between firms in terms of trust, culture, and knowledge structure; 2) managerial capabilities and designs; 3) business strategy and training competence. Mowery et al. (1996) and Lane et al. (2001) wrote articles suggesting that similarity between firms in a strategic alliance expands learning and knowledge sharing.

In contrast to Mowery et al. (1996) and Lane et al. (2001), Nooteboom et al. (2007) (72 in Fig. 4) treated distance as an opportunity rather than an obstacle in inter-organizational knowledge transfer. Their article shifts perspective in IB studies, which commonly treat cognitive distance as a barrier to overcome. Their article finds that firms' exposure to partners with different cognitive and technological capabilities may lead to innovation as distance pushes firms to generate and expand their knowledge to bridge diversity. Nonetheless, large cognitive distances can hinder knowledge transfer due to gaps in communication and cultural understandings. In this situation, AC can diminish the negative effect of distance, and highly advanced AC allows firms to deal with other firms that have large cognitive distances from them.

Tsai (2001) (16 in Fig. 4) expanded the use of the AC construct, arguing that network position and AC affects an organization's ability to acquire knowledge. This article offers a new perspective since previous research suggests a direct impact of network structure on knowledge acquisition, without considering how the impact might depend on the unit's ability to absorb knowledge. In this case, a central unit can benefit from its location because it can access knowledge in its networks, but the ability to absorb knowledge from its network links relies on its AC. Therefore, units that want to develop their networks also need to improve their AC.

In knowledge transfer, the future main research questions concern knowledge-sharing issues (Ritala, Olander, Michailova, & Husted, 2015), the influence of organizational mechanisms on the

ability of firms to learn and transfer different types of knowledge (Nair, Demirbag, & Mellahi, 2016; Schleimer and Pedersen, 2014; Zahra and Hayton, 2008), the role of organizational routines on firms' abilities to explore incremental innovation (Kotabe, Jiang, & Murray, 2011), and the determinants of AC in a situation when involved organizations are both knowledge-recipient and sender (Schleimer and Pedersen, 2014).

4.1.4. Dynamic capability

The leading research question in this stream examines the dimensions of AC, its components and contingency factors, which Zahra and George (2002) (18 Fig. 4) re-conceptualized. In their model, AC consists of four dimensions: knowledge acquisition and assimilation (potential AC) and knowledge transformation and exploitation (realized AC). The researchers argue that dynamic capability affects the ability of firms to create and exploit knowledge to develop other capabilities. Jansen et al. (2005) (46 in Fig. 4) extend the AC model developed by Zahra and George (2002) by demonstrating that organizational mechanisms associated with coordination capabilities and socialization capabilities affect potential and realized AC. In 2006, Lane et al. (2006) (54 in Fig. 4) offered a modified model of AC by proposing that different knowledge processes (exploratory, transformative, and exploitative learning) can enhance a firm's existing AC. Their study extends our understanding about organizational factors that can increase capabilities of firms on applying external knowledge. Dynamic capability is strongly linked to IB, as noted by Luo (2001), because it enables international firms to succeed in performance and expansion. Dynamic capability gives firms the flexibility to adapt and develop in changing markets and turbulent environments (Lichtenthaler, 2009; Zahra & George, 2002).

In the dynamic capability of AC, future research questions address the impact of different types of partners on organizational mechanisms and AC development (Shin, Kim, & Park, 2016), the influence of organizational design on organizational mechanisms and AC development (Björkman et al., 2007), and the relationships between organizational mechanism and the AC process (Noor-derhaven & Harzing, 2009).

4.1.5. Micro-foundations

The primary research questions in this stream examine intra-organizational antecedents of AC, including the roles of

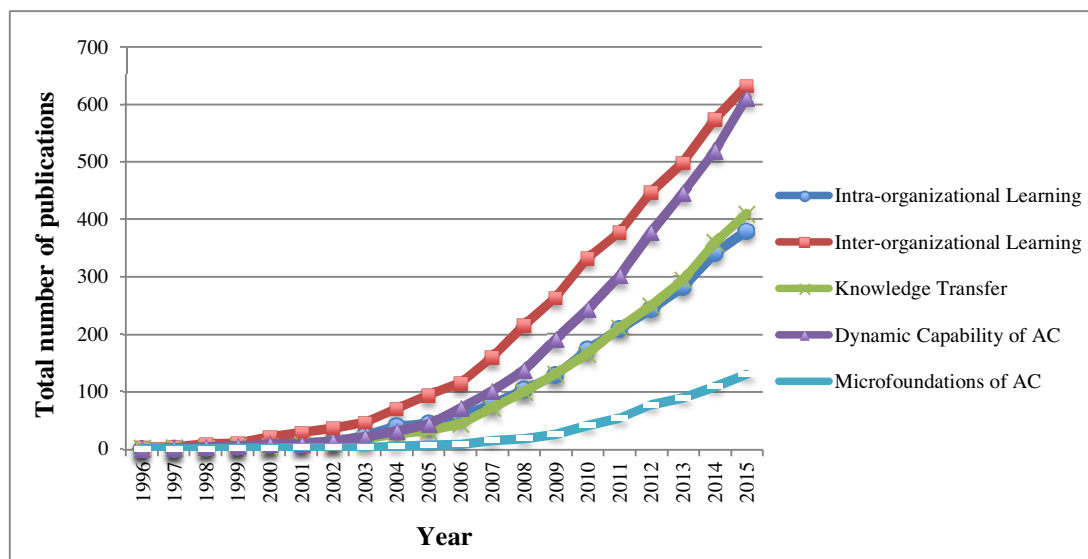


Fig. 4. Total Numbers of Publication of Research Stream.

individuals, micro activities and units within the firm that serve as AC determinants. In 2010, [Volberda et al. \(2010\)](#) (142 in [Fig. 4](#)) established an integrative AC model that determines multilevel antecedents, processes, and outcomes of AC, including contextual factors that influence AC. They argue that AC should be analyzed through its micro and macro antecedents. [Lewin, Massini, and Peeters \(2011\)](#) (162 in [Fig. 4](#)) published a theoretical analysis exploring organizational meta-routines that constitute internal and external AC. They report on meta-routines in the form of practiced routines are vital for AC. The micro- foundation research stream contributes to IB research by focusing on individuals as agents fundamental to knowledge process creation and dissemination in organizations ([Andersson et al., 2016](#)). However, progress in the micro-foundation research stream also poses challenges for scholars in IB research. They need to develop theories and methodologies to study knowledge processes on multiple levels (individual, team, company, industry and country as well as the interactions among them).

For micro-foundations of AC, future research questions focus on the influence of different type of leadership on AC development ([Flatten, Adams, & Brettel, 2015](#)), the effect of leader characteristics on network access and knowledge transfer in a context where managerial ties are important ([Li et al., 2010](#); [Li, Poppo, & Zhou, 2010](#)), learning on the managerial level ([Park & Harris, 2014](#)), the effect of individual differences on knowledge process involvement in a firm ([Caligiuri, 2014](#)), the relationship between individual positions in an internal network structure in organizations and external knowledge ([Tortoriello, 2015](#)), and the role of social integration and organizational mechanisms on AC development at an individual and team level ([Björkman et al., 2007](#); [Posen & Chen, 2013](#)).

4.2. Growth of the absorptive capacity (AC) research stream

Citation mapping does not show the development of each research stream represented by publications. [Fig. 4](#) shows the total number of published articles that represent each research stream from 1990 to 2015 using cartography analysis. This measurement allows us to use keywords to represent each research stream and to calculate the number of publications in each research stream by year.

[Fig. 4](#) shows that the number of published articles in the inter-organizational learning stream is rising faster than in other streams, but the dynamic capability stream is catching up while the micro-foundations stream is left far behind.

4.3. The leading influences on absorptive capacity (AC)

4.3.1. The most influential articles, trending articles, and journals

This sub-section looks at single articles in AC research. [Table 1](#) illustrates the total local citations received within the retrieved articles (TLC) and the total local citations received per year (TLC/t).

Table 1
Ranking of Top 10 Articles (sorted by TGC/t).

Rank	Author(s) Year	TLC	TLC/t	TGC	TGC/t
1	Cohen and Levinthal (1990)	335	12.88	7368	283.38
2	Lane and Lubatkin (1998)	343	25.44	2241	156.93
3	Zahra and George (2002)	247	20.52	1899	151.27
4	Szulanski (1996)	93	4.65	2123	106.15
5	Jansen et al. (2005)	126	14.71	792	72.63
6	Lane et al. (2001)	131	13.31	718	65.90
7	Tsai (2001)	80	5.33	873	58.2
8	Mowery et al. (1996)	73	3.65	927	46.35
9	Lichtenthaler (2009)	41	5.86	298	43.16
10	Lane et al. (2006)	118	11.8	418	41.80

Note: TLC Total local citation received. TLC/t Average local citations received per year. TGC Total global citations received. TGC/t Average global citations received per year. *ordered by TGC/t.

TLC denotes how many times the articles in the local collection (retrieved articles) have been cited by other articles in the collection. It also measures the total global citations (TGC) and the total global citations per year (TGC/t). TGC indicates how many times the articles included in the local collection (retrieved articles) have been cited globally or cited from the articles outside the collection. [Table 2](#) shows the influential articles sorted by the score of LCSe (local citations score in the end), which presents the ratio of local citation of each article in ending. This ratio illustrates whether an article received more citations at the end of the time period studied, or demonstrates whether the article obtains more citations recently.

By taking the number of articles published by each journal related to AC as a proxy of the output of the journals (P_{AC}), with the proxy for the impact based on the total local citations received per year (TLC/t), we can identify the most influential journals. We can categorize the impact of journals into four groups (A, B, C, and D) by calculating the mean values of two variables ($P_{AC} M = 6.32$; $TLC/t = 3.6$). Group A: high focus on AC and high impact; Group B: low focus on AC and high impact; Group C: low focus on AC and low impact; Group D: high focus on AC and low impact. Out of 53 journals, only eight have an above-average impact (groups A and B) and 45 journals have above average output (groups C and D). Detailed information about the total list of journals in all groups can be seen in the [Appendix A](#).

4.3.2. The most influential institutions and countries (centers of excellence)

This sub-section discusses centers of excellence in AC research by examining the country of origin of institutions or universities. We analyze institution contribution by the total of published articles and the impact (citations received) ([Gómez, Bordons, Fernández, & Morillo, 2008](#); [Van Raan, 2008](#)). There are two measurements for citations: the total local citations (TLC) representing the total citations received by an article from the articles in retrieved samples (336 articles), and the total global citations (TGC), which reflects the total number of citations not only in retrieved samples but other articles outside based on the full *ISI* count. The 10 most influential institutions are located in the US, the UK, Spain, China, Germany, Australia, the Netherlands, South Korea, Taiwan, and Belgium.

5. Discussion

Our meta-analysis of the literature using both quantitative and qualitative techniques reveal five interesting and growing areas of AC in the field of IB. Using articles as data, we found there are five key research streams in the AC literature intersecting IB: 1) intra-organizational learning; 2) inter-organizational learning; 3) knowledge transfer; 4) dynamic capability; and 5) micro-foundations. We embed relevant future research questions in each of these streams, through a qualitative analysis of the literature, to develop a research taxonomy.

Going back to the research questions, our first research question about how AC articles clustered was addressed through citation mapping, and we revealed that the subset of 30 articles grouped into five different clusters based on their similarity on topic, and context. We analyzed the content of the papers in each cluster and named them. Generally, AC contributes to IB field by focusing on internal knowledge-building and the interactions between firms, partners and the environment.

To answer the second research question about the research streams that receive the most attention, we employed bibliometric cartography analysis that shows the growth of each research stream. [Fig. 4](#) shows that less attention given to the micro-foundations stream, which might make it an attractive prospective

Table 2
Ranking of Trending Articles (sorted by LCSe).

Rank	Author(s)/Year/Title	Journal	LCSe	TGC/t	TLC/t
1	Lane and Lubatkin (1998). Relative absorptive capacity and inter-organizational learning.	Strategic Management Journal	135	156.93	25.44
2	Cohen and Levinthal (1990). Absorptive capacity: A new perspective on learning and innovation.	Administrative Science Quarterly	123	283.38	12.88
3	Zahra and George (2002). Absorptive capacity: A review, reconceptualization, and extension.	Academy of Management Review	102	151.27	20.52
4	Jansen et al. (2005). Managing potential and realized absorptive capacity: How do organizational antecedents matter?	Academy of Management Journal	82	72.63	14.71
5	Lane et al. (2001). Absorptive capacity, learning, and performance in international joint ventures.	Strategic Management Journal	68	65.90	13.31
6	Lane et al. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct.	Academy of Management Review	55	41.80	11.80
7	Tsai (2001). Knowledge transfer in intra-organizational networks: Effects of network position and absorptive capacity on business unit innovation and performance.	Academy of Management Journal	40	58.20	5.33
8	Todorova and Durisin (2007). Absorptive capacity: Valuing a reconceptualization.	Academy of Management Review	37	28.56	8.22
9	Szulanski (1996). Exploring internal stickiness: Impediments to the transfer of best practice within the firm.	Strategic Management Journal	36	106.15	4.65
10	Volberda et al. (2010). Perspective-absorbing the concept of absorptive capacity: How to realize its potential in the organization field.	Organization Science	35	23.33	7.17
11	Escribano, Fosfuri, and Tribó (2009). Managing external knowledge flows: The moderating role of absorptive capacity.	Research Policy	21	16.43	4.71
12	Lichtenthaler (2009). Absorptive capacity, environmental turbulence, and the complementarity of organizational learning process.	Academy of Management Journal	20	43.16	5.86
13	Mowery et al. (1996). Strategic alliances and interfirm knowledge transfer.	Strategic Management Journal	20	46.35	3.65
14	D. Minbaeva et al. (2003). MNC knowledge transfer, subsidiary absorptive capacity, and HRM.	Journal of International Business Studies	15	34.36	3.49
15	L. Kim (1998). Crisis construction and organizational learning: Capability building in catching-up at Hyundai Motor.	Organization Science	15	15.44	2.11
16	Liao et al. (2003). Organizational absorptive capacity and responsiveness: An empirical investigation of growth-oriented SMEs.	Entrepreneurship Theory and Practice	14	6.38	1.62
17	Nooteboom et al. (2007). Optimal cognitive distance and absorptive capacity.	Research Policy	12	37.90	2.67
18	Lenox and King (2004). Prospects for developing absorptive capacity through internal information provision.	Strategic Management Journal	11	9.50	2.25
19	Chen et al. (2009). The positive effects of relationship learning and absorptive capacity on innovation performance and competitive advantage in industrial markets.	Industrial Marketing Management	11	9	2
20	Camisón and Forés (2010). Knowledge absorptive capacity: New insights for its conceptualization and measurement.	Journal of Business Research	9	8.90	2.93

Note: TLC/t Average local citations received per year. TGC/t Average global citations received per year. LCS/e Ratio of local citation in the ending.

research area. In addition, the more mature research streams also have additional research questions worth advancing.

From bibliometric co-citation analysis we find prominent influences on the AC field, including articles and countries of origin of leading institutions researching AC. We find that 13 out of the top 20 most-highly-cited articles on AC were published from 1990 to 2006, while seven articles were published from 2007 to 2010. The development of AC research occurred primarily in the 1990s and early 2000s, but recent articles need time before they can be sufficiently acknowledged and cited in a citation mapping.

Our third research question about the list of future opportunities to further the role of AC in IB field relies on a more traditional literature review approach using a qualitative evaluation of the literature. We obtained the future research questions from a content analysis of top journal articles proposals for future research, but we modified the questions a bit so they can be applied broadly to fit the IB research frameworks. For example, if Noorderhaven and Harzing (2009) offer research questions such as “does social interaction give managers access to fine-grained information that helps to bring about knowledge integration?” Or “does social interaction mainly help to remove obstacles to knowledge transfer?” We modified to “do organizational mechanisms influence the AC process in a similar way? If not, what kind of management setting and managerial capabilities can effectively shape the different effects of organizational mechanisms on AC?”

At the end, what we have is a synthesis of 26 research questions (shown in Table 3) in five research areas intersecting IB and AC.

Various future research questions suggested by authors may shape development of AC construct hence contributes to the IB field. In intra-organizational learning, the development of this research area focused on the internal learning process and the variables that affect it. Designing future research questions that seek to understand the multi-faceted or layered-factors of internal learning and knowledge creation process in firms can enhance the development of this research area.

In inter-organizational learning, this research area builds on the studies of the role of AC in international knowledge acquisition and the role of alliances partners in the learning process. Thus, it would be beneficial to analyze more deeply at the learning process originating from 1) partners from different context, knowledge base, and hierarchical position, and; 2) firms internal operations and activities beyond the aggregation of know-how and experience.

The knowledge transfer area develops the studies on the challenges and requirements faced by firms to manage their inter-organizational knowledge transfer process. Firms are required to manage internal relationships both in national and international contexts. There is a growing empirical research showing that organizational learning process is the source of firm's competitive advantage. The development of this research field can analyze the

Table 3
Suggested Research Questions.

No	Research Stream	Future Research Questions	Authors
1	Intra-organizational learning	Using a longitudinal study approach, what are the conditions and decisions that help organizations increase their AC? Do different types of knowledge attributes affect the process of AC? If the answer is yes, how does a firm manage different types of AC? What factors determine the speed of AC development? How can firms manage the speed differences across different types of AC? How do incompatible or lower compatibility levels between acquired knowledge and knowledge base affect intra-organizational learning and intra-organizational inertia? Does the intensity of past innovation activities affect firms' knowledge search and which R&D resource used for knowledge search?	Caligiuri (2014) Fang et al. (2013) Schleimer and Pedersen (2014) Minbaeva et al. (2013) Minbaeva et al. (2014) Garriga, von Krogh, and Spaeth (2013) Love et al. (2014) Freeman et al. (2010)
6	Inter-organizational Learning	How do small born-global firms utilize new knowledge and what are the long-term benefits? At which level will the knowledge-seeking behavior appear? What is the sufficiency level of knowledge base that allows a firm to absorb new knowledge? Do different types of relationships have distinctive learning impacts? Does the impact of learning appear mostly through improved selection of partners or through better management of external linkages? Does the change of learning orientation and knowledge sharing form within organizations affect the types of strategic alliances with partners? Does networking have different requirements to increase AC? Do hierarchical networks affect inter-organizational learning since the dominant firm has the power to determine the relationship?	Zhou and Li (2012) Capaldo (2007) Tempel and Walgenbach (2007) Capaldo (2007) Björkman et al. (2007) Ferrerias-Méndez et al. (2016)
11	Knowledge Transfer	What kind of organizational mechanisms apply if a firm wants to conduct different types of knowledge transfer? For instance, what types of organizational mechanisms are needed if a firm wants to find a partner that has complementary, lower, or superior knowledge base? What is the most effective composition of organization mechanism that can help a firm to balance exploitation-exploration activities? Has the firm measured and weighed the positive impact of knowledge transfer and the negative impact of knowledge leakage? Will the level of firm strong appropriability regime be affected by the number and type of partner that it has? Do firms develop different organizational routines to pursue incremental or radical innovation? What factors determine AC in a situation where involved organizations are both knowledge recipient and sender?	Schleimer and Pedersen (2014) Nair et al. (2016) Ritala et al. (2015) Song (2014) Kotabe et al. (2011) Schleimer and Pedersen (2014)
16	Dynamic Capability of AC	Do organizational mechanisms influence the AC process in a similar way? If not, what kind of management setting and managerial capabilities can effectively shape the different effects of organizational mechanisms on AC? Do specific organizational mechanisms become prerequisites when a firm wants to engage in certain types of collaboration? Does a firm build different organizational mechanisms to increase AC when they deal with different types of partners?	Noorderhaven and Harzing (2009) Shin et al. (2016) Sánchez-Sellero, Rosell-Martínez, and García-Vázquez (2014) Shin et al. (2016) Björkman et al. (2007)
20	Micro-foundations of AC	What are the differences between the organization mechanisms in large firm and small firm in terms of building AC? Do organizational hierarchy and structure affect the design of organizational mechanisms? What individual traits determine individual AC? Is managerial AC more essential to firm innovation compared to other individuals ACs? Do the different styles of leadership affect organizational learning (exploitative, explorative, and transformative)? If yes, what are the roles of certain styles of leadership on different type of learning? Do different stages of AC (acquisition, assimilation, transformation, and exploitation) need different styles of leadership? What kind of organizational mechanism allows a firm to develop and nurture its AC at individual and team levels? Does the organizational position of an individual who absorbs external knowledge affect internal learning in their organization?	Caligiuri (2014) Park and Harris (2014) Flatten et al. (2015) Gao, Xu, and Yang (2008) Björkman et al. (2007) Crossan, Maurer, and White (2011)

competitive dynamics of learning, the problems of knowledge leakages, and knowledge properties of networks.

The dynamic capability research area focused on the modification of AC by expanding the knowledge processes model, the variables that affect the model, and the measurement. The development of this field can investigate the flexibility of broad-spectrum of firms (large firms and small firms) to cope with changing environment. AC depends not only on the prior knowledge base, but also its organizational structure and mechanism. Thus, the research questions should be focused on organizational mechanism required in learning, and what organizational mechanism needed when firms have partners that have different AC.

The micro-foundation research area develops the discussion about organizational routines and individual actors that constitute internal and external AC. Firms can be seen as multi-layered actors,

with knowledge that can be shared through the interaction among them and environment. Thus, future research questions may focus on the impact of broad and multidimensional individual actors, their interaction to each other, and to environment that shapes AC. AC should be seen as a bundle of routines, and researcher can analyze the level and routines that can initiate the change and learning in firms. Future research question can also integrate the influence of organizational position and personal quality to organizational learning in hopes to demonstrate whether hierarchical position, individual traits, and leadership style affect AC.

Lastly, through our fourth research question about which channels (journals, articles, and countries) show most influence on AC research, we identified AC authors have come from a number of international institutions, led by American universities and institutions in other highly-industrialized countries. But Chinese, Taiwanese, and South Korean universities are catching up.

6. Limitations and future research

AC is an interdisciplinary construct, and some topics may appear to be more significant than others in bibliometric analysis because they receive more citations. The assumption is that highly cited articles are more important and influential. But, sometimes, articles do not get “discovered” until much later, despite their relative contribution. While we try to scale it to time, newer articles might not show their true potential. It is necessary to repeat citation and co-citation analysis at least once a decade for important constructs so as to see their development and impact on the field.

This study focuses on a database from the *ISI*, and the articles represented are among the most prestigious. There is a bias for high quality publications. Non-*ISI* journal articles that might be impactful are not included. This is a limitation of the *HistCite* model as it is unable to deal with databases of articles from other sources, such as *GoogleScholar* and *Scopus* at this time. Future meta-analyses might be able to integrate articles from lesser quality journals and to capture the impact across a broader spectrum of scholars and disciplines. Finally, future researchers can also use different types of meta-analytic techniques to analyze the literature. The robustness bar for meta-analytic literature reviews will continue to rise to meet the needs of scholars to more deeply understand the state-of-the-art on a particular construct or relation.

7. Conclusion

Borrowing from different theoretical backgrounds, AC can explain how firms behave and why some are better able to adjust to

their environments. This article makes a singular contribution to our understanding of the AC literature by systematically grouping articles into clusters, and raising new research questions.

We found there are five key research streams in the AC literature: 1) intra-organizational learning; 2) inter-organizational learning; 3) knowledge transfer; 4) dynamic capability; and 5) micro-foundations. AC researchers from various disciplines and methods analyze different aspect of AC, and as a result these five research streams demonstrate the evolution of AC by topic, context, and measurement.

The development of AC publications can be seen on the citation mapping and how AC articles grouped into five different research streams. An analysis of the literature over a 25-year period suggests that the AC construct is, indeed, contributing to IB theory and beyond. There is room for additional contributions in several areas and, in particular, in the micro-foundation literature of IB. Prior research offer promising future research questions that may guide the direction of AC research on IB field. Future research questions focused in the processes and capabilities underlying the creation of internal knowledge, as well as the opportunities, challenges and obstacles when firms integrate new knowledge brought beyond their boundaries, from diverse partners and contexts.

Appendix A.

See [Table A1](#).

Table A1
Table of Journal Publishers in Quadrants A–D.

Group A	Group B	Group C	Group D	
High Focus and High Impact	Low Focus and High Impact	Low Focus and Low Impact	High Focus and Low Impact	
1. Research Policy 2. The Strategic Management Journal 3. Technovation 4. The Journal of International Business Studies 5. The Journal of Business Research 6. Organization Science	1. The Academy of Management Journal 2. The Academy of Management Review	1. IEEE Transactions on Engineering Management 2. The Journal of Management Studies 3. Industrial and Corporate Change 4. International Small Business Journal 5. The Journal of Business Venturing 6. The Journal of Supply Chain Management 7. World Development 8. The British Journal of Management 9. The International Journal of Management Reviews 10. The Journal of Management	11. Healthcare Management Review 12. Strategic Organization 13. MIS Quarterly 14. Regional Studies 15. Industry and Innovation 16. The Journal of World Business 17. Management International Review 18. Management Science 19. The Scandinavian Journal of Management 20. Small Business Economics 21. Asia Pacific of Journal Management 22. Creativity and Innovation Management 23. Human Resource Management 24. European Management Review 25. The Journal of International Marketing 26. The Journal of Management Information Systems 27. The Journal of Marketing 28. Management and Organization Review 29. Organization Studies 30. Strategic Entrepreneurship Journal 31. Tourism Management 32. Administrative Science Quarterly 33. Entrepreneurship Theory and Practice 34. The Journal of Small Business Management	1. International Business Review 2. The Journal of Knowledge Management 3. R&D Management 4. Technological Forecasting and Social Change 5. Industrial Marketing Management 6. The Journal of Operations Management 7. The Journal of Product Innovation Management 8. Entrepreneurship and Regional Development 9. European Management Journal 10. European Planning Studies 11. Management Decision

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