

Absorptive capacity in startups: A systematic literature review

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Abstract

Purpose: Several scholars have pointed out that absorptive capacity (AC) is critical for the innovation process in large firms. However, many other authors consider startups as key drivers for innovation in the current global economy. Therefore, this article aims to identify how the concept of AC has been addressed in the new venture context.

Methodology: A systematic literature review analyzing 220 papers published between 2001 and 2018. **Findings:** The systematic literature review identifies three clusters of research addressing AC in startups: Knowledge, Innovation, and Performance, along with the central authors of the discussion, the main contributions, theoretical references, and their future research agenda guidelines. **Implications for theory and practice:** This study contributes to the innovation and entrepreneurship literature by connecting the importance of AC and new venture creation, and providing a better understanding of how entrepreneurs could enhance their innovative processes. **Originality and value:** Based on the analysis of the literature review, a framework that differentiates knowledge acquisition strategies for new ventures was created. The framework categorizes the strategies according to the knowledge source (i.e., internal or external) and the degree of intentionality (i.e., formal or informal).

Keywords: innovation, absorptive capacity, startups, new ventures, entrepreneurship

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INTRODUCTION

Absorptive capacity (AC) is defined by Cohen and Levinthal (1990) as the ability to recognize, identify, assimilate and exploit new external information, and is considered to be critical for the innovation process. Zahra and George (2002, p. 186) defined AC as a “set of organizational routines and processes” including acquisition (to identify and obtain external knowledge), assimilation (to interpret and understand the information obtained), transformation (to integrate and combine existent knowledge with the newly acquired), and exploitation (the application of new knowledge for commercial ends). This ability involves renewing routines, practices, technological paths (March, 1991; McGrath, 2001), but in particular, it involves a learning process (Lane, Koka, & Pathak, 2006).

Previous works have addressed extensively how organizations might benefit from AC. For instance, Patterson and Ambrosini (2015) explored how AC could be configured to support research activities in biopharmaceutical firms, Engelen and colleagues (2014) identified how AC contributes to the strengthening of the entrepreneurial orientation and a firm’s performance relationship, and Lis and Sudolska (2015) studied what role AC plays in organizational growth and competitive advantage. The large number of theoretical and empirical publications addressing the AC construct over the past 30 years has also led to a number of literature reviews with different aims, such as revalidating and reconceptualizing the construct (e.g., Lane et al., 2006; Zahra & George, 2002), identifying major discrepancies among AC’s theoretical perspectives (e.g., Volberda, Foss, & Lyles, 2010), and analyzing the multifaceted dimensions of AC literature (e.g., Apriliyanti & Alon, 2017).

However, unlike these past reviews, in the present study, we propose to analyze AC in the context of new ventures, mainly due to two factors. First, because several authors have argued that startups are better suited to develop radical innovation (Bower & Christensen, 1995; Edison, Smørsgård, Wang, & Abrahamsson, 2018; Spencer & Kirchhoff, 2006). According to Giardino et al. (2014, p. 28), startups are entities “exploring new business opportunities, working to solve a problem where the solution is not well known and the market is highly volatile.” These organizations are characterized by a lack of resources, rapid evolution, small teams, little working experience, third-party dependency, and work under several uncertainties (Giardino et al., 2014). Despite the shortcomings associated with the scarcity of resources and experience (Ambos & Birkinshaw, 2010), these firms are able to launch innovative products and become a ‘game-changer’ in traditional industries, putting incumbent firms under pressure (Edison et al., 2018; Sirén, Hakala, Wincent, & Grichnik, 2017). Second, because, despite being game-changers,

startups operating in technology-intensive industries suffer the permanent threat of premature obsolescence since –and considering the high level of uncertainty– these companies often bet on ‘failed technologies’ (i.e., those technologies that result not to be the ones adopted by the market (Eggers, 2012) and to survive, they must revamp their knowledge to adjust their solutions for which the AC may be crucial. Therefore, we identified a necessity to analyze AC literature within the context of new ventures in order to better understand which topics have been studied in this regard, and try to identify which aspects can be extracted from the main findings to contribute to some extent to the improvement of entrepreneurs’ processes of knowledge renewal and innovation.

The aim of our research is to determine how the concept of AC has been addressed in the new venture context by identifying the clusters of research, the main authors, and findings. To this end, we proceeded to conduct a systematic literature review analyzing 220 papers published between 2001 and 2018. Three clusters of research regarding the importance of AC in the new venture context were identified: Knowledge, Innovation, and Performance. In addition, the central authors of the discussion were reviewed, including their main contributions, theoretical references, and future research agenda.

The text is structured as follows: section 2 reviews the concepts and discussions about dynamic capabilities and new ventures, followed by the methodology in section 3. Our results are presented in section 4, including the bibliometric and content analyses. In section 5, we discuss the findings, and the last section contains the conclusions and suggestions for future research.

LITERATURE BACKGROUND

Authors such as Zahra and George (2002) and Engelen et al. (2014) have recognized AC as a dynamic capability. Dynamic capabilities (DC) enable the firm to evolve and positively influence its competitive advantage (Zahra & George, 2002, p. 185). Given that the present study seeks to connect concepts from the strategic management (i.e., AC and DC) and entrepreneurship fields, it is important to discuss in which way this interaction could be addressed considering the still ongoing debate about these concerns (Arend, 2014). Teece, Pisano, and Shuen (1997, p. 516) defined DC as “the firm’s ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments.” DC is tied to the resource-based theory, in which firms’ differences, such as resources, skills or endowments, are key aspects that help companies to create a sustainable competitive advantage (Barney, 1991). However, DC complements the resource-based theory by

providing the abilities for controlling, configuring, and reconfiguring the resources for long-term survival.

According to Teece et al. (1997), resources and assets are arranged in integrated groups of individuals that perform the firms' activities or routines. In other words, through functions, routines, and competences, firms take advantage of their resources. However, differently from incumbent firms, new ventures lack functions and routines, so they need to rely broadly on team members' and entrepreneurs' idiosyncratic knowledge to operate (Bergh, Thorgren, & Wincent, 2011). In this regard, literature offers some examples of how DC has been addressed focused on individuals. For instance, Teece (2012) points out that there is a group of DC that is based on the individual "skills and knowledge of one or a few executives rather than on organizational routines" (Teece, 2012, p.1). According to the author, capabilities are built jointly by individual skills and collective learning originating from employees working together. In addition, the author notes that entrepreneurial management, besides being concerned about the improvement of existent routines, is more about creating new ones and figuring out new opportunities. Finally, Teece mentioned that the dependency on individual skills usually fades over time after five or ten years.

The individual approach in DC is associated with the concept of micro-foundations, which are one of the aspects that undergird the capabilities. According to Teece (2007, p. 1319), micro-foundations are the mechanisms through which sensing, seizing, and reconfiguring capacities operate; these include "the distinct skills, processes, procedures, organizational structures, decision rules, and disciplines." Certainly, all these mechanisms widely depend on individual cognition (Helfat & Peteraf, 2015) and individuals' extant knowledge (Teece, 2007). Helfat and Peteraf (2015) suggest that individual cognitive capabilities may mediate the relationship between changes in the organizational environment and strategic changes, and, therefore, individuals (by the effect of their own capacities) can reshape their organizations.

Several scholars have also discussed DC from the entrepreneurship perspective (for instance, Arend, 2014; Arthurs & Busenitz, 2006; Boccardelli & Magnusson, 2006; Newbert, 2005; Zahra, Sapienza, & Davidsson, 2006). These works offer different alternatives to connect both of the research strands (i.e., DC and entrepreneurship). For instance, Newbert (2005) proposes the new firm formation process as a dynamic capability, based on a random sample of 817 entrepreneurs; he concludes that there is evidence to support that new firm creation meets the DC conditions placed by Eisenhardt and Martin (2000) (i.e., identifiable, unique, deals with market dynamism, and is affected by learning). Arthurs and Busenitz (2006) set out that after the opportunity identification, when entrepreneurial leadership starts to transition to a more

formal type of management, new ventures need to develop new skills –as mentioned by Teece (2012)– through the usage of DC. Furthermore, Arend (2014) found out that most entrepreneurial ventures have been created based on DC from the beginning, and mainly on an individual level.

RESEARCH METHODS

With the aim of determining how the concept of AC has been addressed in the startups' context, we conducted a systematic literature review (SLR). This methodology is a rigorous and well-defined approach that enables the identification of the current knowledge and what is known about a given topic (Boell & Cecez-Kecmanovic, 2015). Following Denyer and Neely (2004), we endeavored to develop an accurate process considering the planning, the use of explicit and reproducible selection criteria, and an analysis procedure. Figure 1 summarizes our systematic review process.

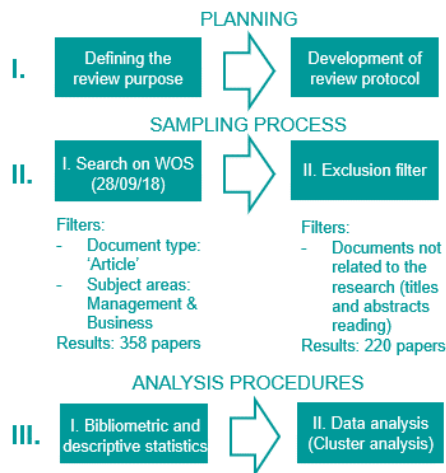


Figure 1. Summary of the systematic review process

Planning the SLR

During the planning phase, we determined the purposes of the research and its most important aspects. Our main goal was to identify how past research employed AC in an entrepreneurship and startups context. We did not limit the research to any specific time frame and only peer-reviewed articles were included. We conducted a search in September 2018 on the Web of Science (WOS, Clarivate Analytics) database since it is one of the most complete peer-

review journal repositories on social sciences (Crossan & Apaydin, 2010). We defined two subject areas, “Management” and “Business,” and searched in all the indexes provided on WOS (SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, and ESCI). Given the wide diversity of terms and morphological variety to refer to a “recently created innovative company”, we applied the following Boolean search keywords: “((absorptive capacity) AND (“startup” OR “start-up” OR “start up” OR “new firm*” OR “NTBF” OR “new venture” OR “entrepreneur*))” in the Topic (title, keywords or abstract) category.

Sampling process

The search returned 358 papers. An exclusion filter was applied to select only documents that address AC in the context of entrepreneurship, on the basis of a thorough reading of titles and abstracts. In order to minimize bias in this filter parameter, the documents were reviewed in two rounds by the researchers. The final search process yielded 220 documents published between 2001 and 2018.

Data analysis

We performed bibliometric and statistical analyses to provide an overview of the literature, including the publications per year and the main journals. We also carried out a network analysis employing the VOSviewer 1.6.9 Software. The data was extracted directly from WOS, including all the information items (e.g., title, abstract, keywords, publication year, cited references, etc.). Then, we manually removed the non-related documents using Microsoft Excel. These data were exported to a text file (*.txt) and imported to VOSviewer to create the co-occurrence and co-citation networks in order to identify the main theoretical references and central discussions. We used the default settings of the program, as presented in Table 1.

Table 1. Default settings of VOSviewer

Parameter	Default settings
Counting method	Full counting
Method of normalization	Association strength
Layout of attraction repulsion	2
Layout of repulsion	0
Clustering resolution	1.00
Minimum size of clusters	1
Merging small clusters	Switched on

Based on the all keywords co-occurrence network, we identified three clusters of lines of research: knowledge, innovation, and performance. Afterward, we proceeded to classify all the papers of our database into these three clusters using Microsoft Excel. After reading the documents, we selected the most relevant articles that matched the research goal and the clustering parameter as well. A total of 50 papers satisfied these parameters and are discussed in the content analysis. The documents were manually coded using the Mendeley Desktop 1.19 software and Microsoft Excel, considering the following aspects: 1) Authors, 2) Year of publication, 3) Journal, 4) Type of article, 5) Aim of research, 6) Relevance of absorptive capacity, 7) Methodology, sample, and variables, 8) Findings, and 9) Future research agenda. We provide a detailed explanation of the coding process in Appendix A (Knowledge cluster; Innovation cluster; Performance cluster.)

RESULTS

Bibliometric and descriptive analyses

Figure 2 shows the evolution of publications over time. It is observed that the earliest paper in the sample was published in 2001; from 2009, there is an increase in the number of publications, reaching a peak in 2015 with 26 publications. The 220 articles are distributed over 77 journals. Table 2 shows the most representative journals accounting for about 60 percent of the sample.

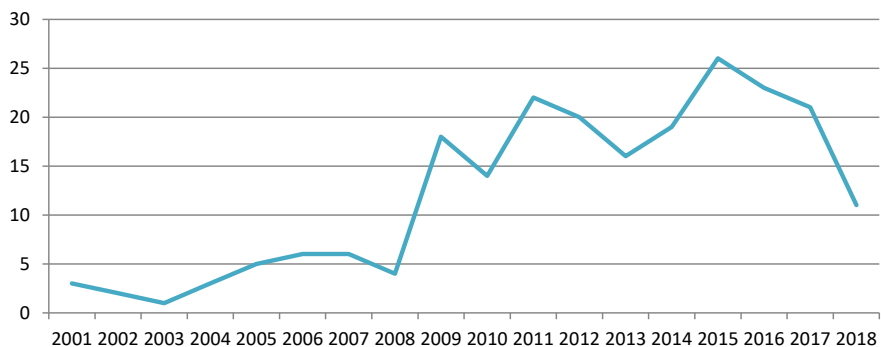


Figure 2. Number of papers published on AC and Startups over time

Table 2. Most common outlet journals

Abbreviation	Full Title	Articles
JBV	JOURNAL OF BUSINESS VENTURING	16
SEJ	STRATEGIC ENTREPRENEURSHIP JOURNAL	12
ET&P	ENTREPRENEURSHIP THEORY AND PRACTICE	11
JSBM	JOURNAL OF SMALL BUSINESS MANAGEMENT	11
IBR	INTERNATIONAL BUSINESS REVIEW	10
RP	RESEARCH POLICY	10
SBE	SMALL BUSINESS ECONOMICS	9
ERD	ENTREPRENEURSHIP AND REGIONAL DEVELOPMENT	7
JWB	JOURNAL OF WORLD BUSINESS	7
JTT	JOURNAL OF TECHNOLOGY TRANSFER	6
R&DMANAGE	R & D MANAGEMENT	6
SMJ	STRATEGIC MANAGEMENT JOURNAL	6
IJTM	INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT	5
JMS	JOURNAL OF MANAGEMENT STUDIES	5
EMJ	EUROPEAN MANAGEMENT JOURNAL	4
IMM	INDUSTRIAL MARKETING MANAGEMENT	4
ISBJ	INTERNATIONAL SMALL BUSINESS JOURNAL	4
	Total:	133

In order to identify the central authors, we performed a co-citation analysis based on cited authors. This analysis builds a network based on the citation link (where one item cites the other). We set this parameter to a minimum of “40 citations of an author,” resulting in 41 central authors, as seen in Figure 3.

The map shows the number of citation links (represented by the number of lines) and the link strength (represented by the distance between items), which refers to a similarity measure normalized by the association strength (van Eck & Waltman, 2010). Zahra S. is the author with the most citation links (412) and total link strength (6082) followed by Cohen W. with 233 and 3067, respectively. The number of links and total link strength of the central authors is displayed in Table 3.

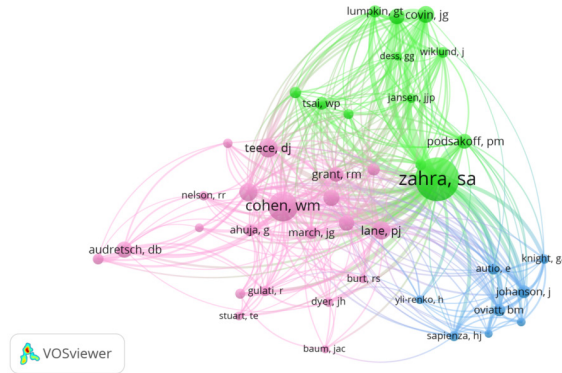


Figure 3. Co-citation author network

Table 3. Citation link and link strength of the co-citation author network

Author	Citation link	Link strength	Author	Citation link	Link strength
Acs Z.	58	841	Kogut B.	97	1653
Ahuja G.	67	1103	Lane P.	121	1879
Audretsch D.	101	1290	Lumpkin G.	66	1261
Autio E.	56	1100	March J.	72	1214
Barney J.	54	874	McDougall P.	44	827
Baum J.	40	605	Miller D.	95	1747
Burt R.	44	823	Nelson R.	47	727
Chesbrough	41	500	Nonaka I.	69	1097
Cohen W.	233	3067	Oviatt B.	69	1366
Coviello N.	40	829	Podsakoff P.	87	1537
Covin J.	105	2012	Rothaermel F.	51	709
Dess G.	42	771	Sapienza H.	53	984
Dyer J.	48	947	Shane S.	116	1694
Eisenhardt K.	99	1487	Shumpeter J.	46	728
Grant R.	86	1469	Stuart T.	42	603
Gulati R.	51	975	Teece D.	123	1888
Helfat C.	61	995	Tsai W.	72	1278
Hitt M.	58	1015	Wiklund J.	58	1208
Jansen J.	49	887	Yli-renko H.	41	814
Johanson J.	74	1444	Zahra S.	412	6082
Knight G.	47	914			

Top 10 Co-citation references network

We also built another co-citation network but based on the analysis of cited references to find commonalities in the theoretical background. The resultant network, exhibited in Figure 4, contains the top ten cited references. We present a brief description of these publications below.

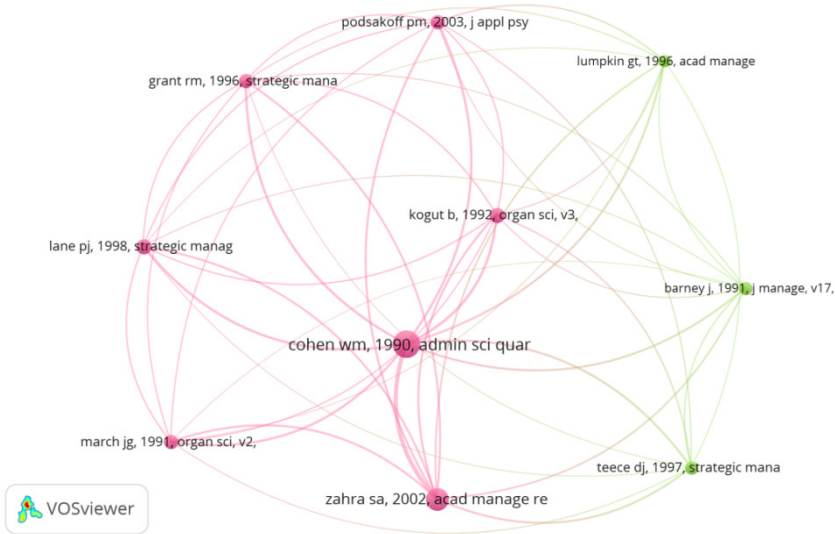


Figure 4. Top 10 Co-citation references network

Cohen and Levinthal (1990, p. 128) introduced the term AC to refer to the “ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends.” The authors argue that AC is critical to the firms’ innovative capabilities, and it requires prior related knowledge to evaluate and utilize the outside new knowledge. Similarly, March (1991, p. 83) suggested that knowledge “makes performance more reliable,” and learning and technological changes might improve competitive advantage. In this study, March popularized the idea that firms must enhance their technological explorative and exploitative abilities and look for a balance between them in order to ensure survival and achieve better performance. In this regard, Barney (1991), aiming for a more comprehensive understanding of sustained competitive advantage, proposed that some resources and characteristics (such as heterogeneity, valuable, rareness, or inimitableness) are crucial for a firm’s competitiveness, and they may vary over time.

To Kogut and Zander (1992), one central aspect of the competitive dimension is the ability to transfer knowledge within the firm. The authors drew on the perspective that organizations are repositories of tacit and explicit knowledge, skills, and social networks, which enable companies to learn new abilities by recombining their existent resources and capabilities. In this same vein, Grant (1996) explores how to integrate the specialized knowledge of individuals into firms. Drawing on the resource-based theory, Grant (1996, p. 110) conceptualizes the knowledge-based view as a new perspective to understand a company, placing knowledge as “the most strategically important of the firm’s resources.” Additionally, he identified the key characteristics of knowledge in order to create value: transferability (the capacity of transference across individuals), capacity of aggregation (the potential to add new knowledge to the existing one), and appropriability (the ability of the owner of a resource to receive a return).

Alternatively, Lumpkin and Dess (1996) explore the relationship between entrepreneurial orientation (EO) and firm performance. The authors defined EO as the practices, processes, and decision-making activities that lead the firm to enter new or existing markets, and is characterized by the “propensity to act autonomously, a willingness to innovate and take risks, and a tendency to be aggressive toward competitors and proactive relative to marketplace opportunities” (Lumpkin & Dess, 1996, p. 137).

In order to address the question of how firms achieve sustained competitive advantage, Teece et al. (1997) proposed the dynamic capabilities concept. As discussed in section 2, this perspective “emphasizes the development of management capabilities, and difficult-to-imitate combinations of organizational, functional and technological skills” (Teece et al., 1997, p. 510). Similarly, from the basis that not all firms have equal chances to acquire knowledge, Lane and Lubatkin (1998) reconceptualized the construct of AC as a dyad-level construct and established some conditions for this interaction to occur: the specific type of knowledge, similarities in practices, logic and organizational structure, and familiarities between the firms. Zahra and George (2002) also reconceptualized AC as a dynamic capability related to knowledge creation and exploitation in order to gain sustained competitive advantage. Additionally, they proposed that AC is built upon two capacities: potential capacity (knowledge acquisition) and realized capacity (knowledge transformation and exploitation). Ending this top ten references network, Podsakoff et al. (2003) present an important methodological review about biases in behavioral research methods that are often employed and cited by AC researchers. The authors summarized the most common sources of method biases, their effects, and techniques to control them.

Content analysis

Finally, we created the co-occurrence map using all keywords as the unit of analysis, as presented in Figure 5. We used the default parameter of a minimum of 10 occurrences of a keyword (Eck & Waltman, 2018). According to Gomes et al. (2016), keywords maps are widely used by researchers and help to establish a general idea on a certain subject. From this map, three clusters of lines of research addressing AC in startups were identified: knowledge (26 articles), innovation (11 articles), and performance (13 articles). Based on these clusters, we performed our data analysis and identified the following codes: 1) Authors, 2) Year of publication, 3) Journal, 4) Type of article, 5) Aim of research, 6) Relevance of absorptive capacity, 7) Methodology, sample, and variables, 8) Findings, and 9) Future research agenda.

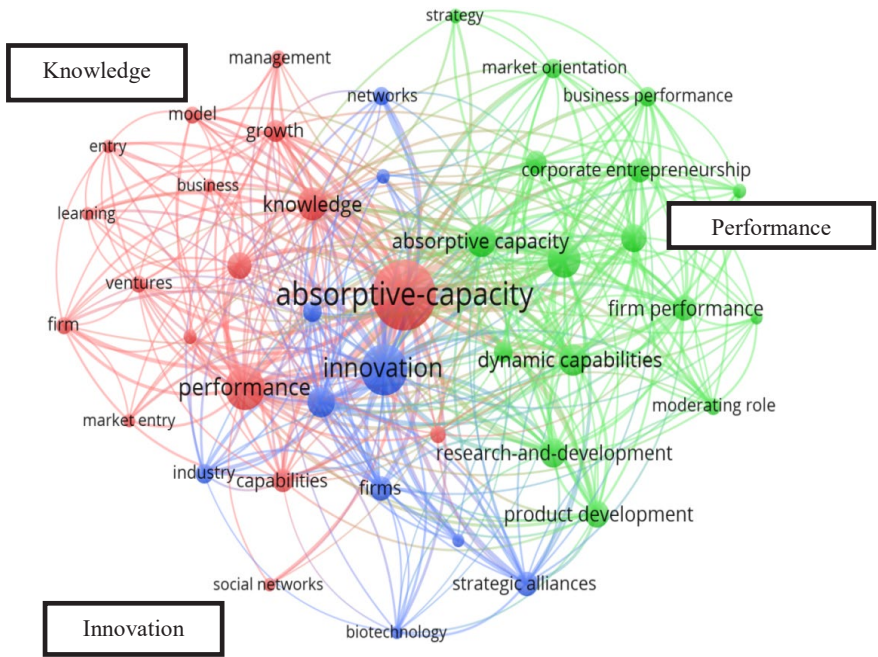


Figure 5. Co-occurrence map using all keywords

Knowledge cluster

New knowledge is an essential input factor for innovation and new firm's progress (Mueller, 2006; Prashantham & Young, 2011; Sullivan & Marvel, 2011; McKelvie, Wiklund, & Brattström, 2018; Bingham & Davis, 2012) by offering the possibility of renewing existent skills, technological paths, and developing innovative capabilities to improve competitive advantage and stimulate growth (Zahra, Filatotchev, & Wright, 2009; Agarwal, Audretsch, & Sarkar, 2010). Several authors recognize R&D as a major vehicle to acquire new knowledge (Acs, Braunerhjelm, Audretsch, & Carlsson, 2009; Mueller, 2006). However, very often, new and small firms do not have the resources to structure an R&D department; thus, partnerships with institutions such as universities or research laboratories are crucial to develop new knowledge (Hayton & Zahra, 2005; Hayter, 2013; Carayannis, Provan, & Grigoroudis, 2016; Dai, Goodale, Byun, & Ding, 2018). Sullivan and Marvel (2011) emphasize that technology and market knowledge is highly important to achieve positive results and enhance the innovative process. In any case, direct inter-personal contacts and proximity to the environment are useful to access knowledge (including tacit knowledge) faster and more successfully (Mueller, 2007, p. 356).

Based on Huber (1991), De Clercq et al. (2012) categorized knowledge acquisition (KA) into five types: experiential learning (learning from experience), vicarious learning (learning by observing others), searching (learning by searching for specific information), grafting (learning by incorporating entities that possess knowledge), and congenital learning (drawing on intrinsic knowledge gained from founders or personal experience). Differently, Carayannis, Provan, and Givens (2011) proposed to classify KA into two groups regarding the form of acquisition: (1) formal KA and arbitrage (referring to the intended ability to manage and apply knowledge for a specific purpose), and (2) informal KA and serendipity (referring to the unintended rewards of enabling knowledge from different sources).

Friesl (2012) identified four knowledge acquisition strategies: "low key" in which there are low levels of collaborative and internal learning and low performance as well; "mid-range," where the emphasis is on collaborative and market-based learning but low levels of internal learning; "focus," where the firms' efforts concentrate on both collaborative and internal learning; and "explorer," in which firms have high mean values for all knowledge acquisition categories (i.e., collaborative, internal, and market-based learning). In this latter group, firms have a particular interest in renewing their knowledge base in order to achieve the highest level of performance.

We identified three recurrent research topics in the present cluster: entrepreneurial internationalization (EI), spin-offs, and identification of

opportunities. The first topic, EI, explores how new firms go about looking to expanding their activities into foreign markets (De Clercq et al., 2012; Bruneel, Yli-Renko, & Clarysse, 2010; Yu, Gilbert, & Oviatt, 2011). Considering that entering foreign markets might entail the obsolescence of existing knowledge and capabilities, to acquire new knowledge becomes crucial to successful internationalization (De Clercq et al., 2012; Prashantham & Young, 2011; Bruneel et al., 2010; Fernhaber, McDougall-Covin, & Shepherd, 2009; Tolstoy, 2009). Therefore, AC emerges as a cornerstone for new venture survival and a critical factor for growth (Mueller, 2007; Qian & Acs, 2013; Moon, 2011). Some studies point out that networks and alliances may enable and accelerate initial commercial activities in new markets (Bruneel et al., 2010; Yu et al., 2011; Sullivan & Marvel, 2011; Perez, Whitelock, & Florin, 2013), and support the absence of in-house translators of new knowledge as suggested in AC theory (Cohen & Levinthal, 1990).

The second topic of research studies is the creation of spin-offs as a vehicle to commercialize new knowledge developed in public research institutes, in large incumbent firms, or in universities (Knockaert, Ucbasaran, Wright, & Clarysse, 2011; Qian & Acs, 2013; Hayter, 2013; Patton, 2014). Qian and Acs (2013, p. 191) argued that the level of knowledge spillover entrepreneurship depends not only on the speed or level of knowledge creation, but also on entrepreneurial absorptive capacity (EAC), defined as the “ability of an entrepreneur to understand new knowledge, recognize its value, and subsequently commercialize it by creating a firm.” Different from Cohen and Levinthal’s AC concept, EAC focuses on the entrepreneur’s abilities –not on the firm’s abilities– and involves the capacity to build a new business.

The third and last topic considers AC as a means to identify opportunities and enhance the firm’s performance (McKelvie et al., 2018; Saemundsson & Candi, 2017). Due to the fact that existing knowledge base might become obsolete within a short period of time, new ventures must intensively promote the search for novel knowledge, primarily in market and customer knowledge (McKelvie et al., 2018). Regarding the principles of AC set by Cohen and Levinthal (1990), to absorb new knowledge requires certain existent abilities. This is probably a challenge for startups because, in many cases, they are building new markets and customers have not been identified at all. In this respect, McKelvie et al. (2018) suggest that new ventures may not over-rely on external knowledge acquisition, especially when the firm works in a highly dynamic sector. Furthermore, Saemundsson and Candi (2017, p. 43) proposed to divide potential AC into “problem absorptive capacity, i.e. the ability to identify and acquire knowledge of the goals, aspirations and needs of current and potential customers, and solution absorptive capacity, i.e. the ability to identify and acquire external knowledge of solutions to fulfill

them.” The authors found out that changes in problem absorptive capacity are a stronger trigger for identification of new opportunities than changes in solution absorptive capacity.

Innovation cluster

According to Dushnitsky and Lenox (2005a, 2005b), Corporate Venture Capital (CVC) carry a potential innovative benefit. The authors suggest that the greater the firm’s AC, the greater the firm’s investment in entrepreneurial new ventures and, therefore, the firm’s innovation rate (Dushnitsky & Lenox, 2005b, 2005a). Nevertheless, the role of AC is not restricted to an enabler of innovation. In fact, access to new information provided by CVC can improve the AC of the firms (Wadhwa & Hall, 2005), although this strategy may limit the knowledge created. Similarly, Lee, Kim, and Jang (2015) argue that the firm’s knowledge diversity enables corporate investors to acquire and maximize useful knowledge.

On the other hand, Winkelbach and Walter (2015) found out that prior knowledge held by the firms has a non-significant effect on value creation. Knowledge creation and knowledge-related learning capabilities (which are moderated by AC) enable firms to deal with dynamic environments to create value and develop innovation. Scholars approach the pursuit of new knowledge by firms to promote innovation in different ways. For instance, human mobility across national borders may foster knowledge creation (Liu, Wright, Filatotchev, Dai, & Lu, 2010). The new knowledge may come from scientists and engineers that return from abroad to start up a new venture in their native countries (Liu et al., 2010). Regarding the type of source of new knowledge (i.e., internal or external), Kamuriwo, Baden-Fuller, and Zhang (2017) point out that external knowledge development is more associated with breakthrough innovations and with a faster time-to-market.

Nevertheless, existing literature suggests that there are some setbacks related to knowledge acquisition and innovation. Marvel (2012) pointed out that sometimes knowing less is better to create innovation. His findings suggest that acquiring the knowledge of ways to serve markets is “negatively associated with innovation radicalness” (Marvel, 2012, p. 464). Therefore, the less knowledge about existing offerings in the market and how they work, the greater the chances for developing breakthrough innovations.

Knowledge acquisition can also stem from universities in the form of academic entrepreneurship, technology transfer, and research commercialization. Using the AC perspective, two multiple case studies explored the Proof of Concept (PoC) process within a University Science Park Incubator (UK) and provided evidence that AC plays a crucial role in obtaining

commercial outcomes (McAdam, McAdam, Galbraith, & Miller, 2010; McAdam, McAdam, & Brown, 2009).

Finally, network market orientation is found to make a significant contribution to the development of AC in international new ventures. Monferrer, Blesa, and Ripollés (2015) showed that network market orientation facilitates the development of dynamic adaptive and absorptive capabilities, which influence their capacity to develop innovative, dynamic capabilities.

Performance cluster

AC might also moderate the firm's performance (Nielsen, 2015; Zahra & Hayton, 2008). In our review, we found two perspectives of performance: addressed as a capability to innovate and as a financial output. Typically, firms engage in activities such as acquisitions, alliances and CVC when pursuing growth and profitability. Yet, it is not completely clear how these activities may influence the firm's performance. To that end, Zahra and Hayton (2008) suggest that AC moderates this relationship. According to their findings, after studying 217 global manufacturing firms, the investments made for building AC positively influence the firm's performance benefits derived from international venturing. Conversely, Benson and Ziedonis (2009, p. 330) argue that "internal technological capabilities remain a critical determinant of success in innovation-driven acquisitions." A limit on CVC investment is imposed by the acquirer's total R&D expenditures, and beyond this limit, the firm's performance starts to improve at a diminishing rate. Wales, Parida, and Patel (2013) posit that the relationship between AC and financial performance is mediated by Entrepreneurial Orientation (EO) referred to as the "strategy-making practices, management philosophies, and firm-level behaviors that are entrepreneurial in nature" (Anderson, Covin, & Slevin, 2009, p. 220).

Based on an individual perspective of AC, Nielsen (2015) proposes that individuals with higher levels of education have also higher absorptive and learning capacities that leverage the likelihood of firms' survival and growth. Additionally, some authors (for instance, Rhee, 2008; Witt, 2004) claim that, in general, the social network represents the theoretical lenses used to investigate performance and startup success. Surprisingly, Rhee (2008) found that social networks of the startup's team members do not help their ventures to reap superior performance. By comparing university and corporate spin-offs, Clarysse, Wright, and Van de Velde (2011) revealed that different characteristics in the technological knowledge base (e.g., specificity, newness, or tacitness) influence the spin-off's performance and growth. According to Simsek and Heavey (2011), corporate entrepreneurship impacts positively the knowledge-

based human, social, and organizational capital and is also positively associated with the firm's performance (i.e., profitability and growth).

Considering international sales performance, Javalgi, Hall, and Cavusgil (2014) argue that AC has a positive relation with customer-oriented selling and performance in international B2B settings. Furthermore, Un and Montoro-Sanchez (2011) define performance as the development of new technological capabilities through investments in R&D. Their research uncovered that the prior capabilities enable the firm to develop new technological ones. In another approach, Zheng, Liu, and George (2010) suggest that a key performance indicator is the valuation or market value, which is influenced by the innovative capability and the network heterogeneity of the firms.

Dynamic and operating capabilities must interact to enable entrepreneurship (Newey & Zahra, 2009). AC may be a key knowledge-based mechanism, which connects learning at both product development and portfolio planning levels. Finally, Deeds (2001) suggests that there is a positive relationship between a high technology venture's R&D intensity, technical capabilities, and AC and the amount of entrepreneurial wealth created by the venture.

DISCUSSION

On the basis of the issues raised in the previous section, we observed a relationship between the three clusters: firms employ and develop their AC in order to identify and transform new knowledge into innovation projects, which in turn leads to performance improvement and growth (see figure 6). This relationship is confirmed by authors such as Mueller (2006), who emphasizes the contribution of new knowledge and knowledge exploitation as valuable inputs for economic regional growth. Moreover, Zahra et al. (2009) reinforce the idea that for a startup to grow, it is necessary to revamp its skills, replace its dated capabilities, and build up new ones. In this regard, AC plays an important role as an enabler for integrating knowledge from different sources. Another approach that supports the relationship presented in Figure 6 is the innovation capability because this construct integrates the creation or appropriation of new knowledge, the transformation of that knowledge into new or improved products, and the firm's progress or performance enhancement (Aas & Breunig, 2017).



Figure 6. Relationship between the three clusters

We identify that there are open discussions about different aspects. The first is the favorability of certain types of knowledge sources (i.e., internal or external) for developing innovations. McKelvie et al. (2018) argue that in highly dynamic environments, the payoff attributed to investments in externally acquired knowledge is not significant. In this same vein, Marvel (2012) found out that knowing less is better to create innovation; the less knowledge about existing offerings in the market, the greater the chances for developing breakthrough innovations. Conversely, Kamuriwo et al. (2017) claim that external knowledge development is more associated with breakthrough innovations and with a faster time-to-market. The second aspect is the role of prior knowledge. On the one hand, Winkelbach and Walter (2015) identify the sole reliance on prior knowledge may foster traps and hinder the ability to foresee opportunities. On the other hand, Un and Montoro-Sanchez (2011) argue that prior stock of knowledge and capabilities enable the development of new ones and thus ensure value creation. Finally, there are some mismatches related to the volume of new knowledge required for developing breakthrough innovations; in the discussion set out by Marvel (2012) it is not clear whether large amounts of knowledge are favorable or not in the development of radical innovation products.

There are three major reasons for companies to engage in knowledge renewal: to address the evolving character of environmental conditions and customer's preferences for enabling growth (Marvel, 2012; Perez et al., 2013; Zahra et al., 2009), to enter into foreign markets (i.e., internationalization) (Prashantham & Young, 2011; Rhee, 2008; Tolstoy, 2009), and to identify entrepreneurial opportunities (McKelvie et al., 2018; Saemundsson & Candi, 2017). Regarding the types of strategies for knowledge acquisition, we identified two of the former: formal and informal (Carayannis et al., 2011), and two of the latter: internal and external (Friesl, 2012) (see Figure 7).

Types of strategies for acquiring knowledge

		Internal	External
Types of Knowledge Acquisition	Formal	<ul style="list-style-type: none"> • Experiential • Vicarious • Searching • Congenital 	<ul style="list-style-type: none"> • Grafting • Human mobility • Partnerships with universities and institutions • Social networks • Acquisitions and alliances
	Informal	Serendipity (unintended process)	Serendipity (unintended process)

Figure 7. Types and strategies of knowledge acquisition

Internal–formal strategies comprise four categories: experiential learning (learning from experience), vicarious learning (learning by observing others, for instance, customers or competitors), searching (learning by searching for specific information), and congenital learning (drawing on intrinsic knowledge gained from founders or personal experience) (De Clercq et al., 2012). On the other hand, external–formal strategies include grafting (learning by incorporating entities that possess knowledge) (De Clercq et al., 2012), human mobility (i.e., knowledge transfer from the exchange of experience as a result of human mobility across national borders) (Liu et al., 2010), partnerships with universities and technology institutions (Clarysse et al., 2011; Mueller, 2006), social networks (Newey & Zahra, 2009; Witt, 2004), and acquisitions and alliances (Dai et al., 2018; Yu et al., 2011; Zahra & Hayton, 2008). Both internal–informal and external–informal are based on the serendipity approach, which refers to the unintended rewards of enabling knowledge from different sources (Carayannis et al., 2011).

From the review, we highlight three recommendations for startups concerning absorptive capacity. First, considering the resource limitations of startups, developing partnerships with institutions such as universities or research laboratories could enhance the capacity for identifying and gathering new knowledge (Hayton & Zahra, 2005; Hayter, 2013). Second, networking, direct inter-personal contacts, and proximity to the environment are useful to access knowledge and become crucial to successful internationalization (De Clercq et al., 2012; Mueller, 2007). Finally, in order to improve the opportunities recognition, new firms should emphasize the problem

absorptive capacity, in other words, in identifying and acquiring knowledge related to the aspirations and needs of current and potential customers, instead of on existent solutions (Saemundsson and Candi, 2017)

Additionally, some common issues among researchers were identified. First, there is wide adoption of the definition of AC proposed by Cohen and Levinthal (1990) as the mechanism through which firms identify, acquire, and exploit new knowledge in order to achieve more sustainable levels of growth. Second, internal capabilities enable the firm to transform new knowledge into value. Third, intellectual property rights may inhibit the openness to acquire external knowledge and limit the offers to receive venture capital.

CONCLUSION AND FUTURE RESEARCH AGENDA ---

The purpose of this paper was to identify how the concept of AC has been addressed in the new venture context. We selected 220 documents and applied a systematic literature review method that evidenced three clusters of research: knowledge, innovation, and performance. We concluded that the AC construct first conceived by Cohen and Levinthal in 1990 still stands as an important theoretical lens. Several scholars used the concept in its original context, but others extended it to other research fields, such as the role of AC in universities and research institute spin-offs, corporate venture capital, entrepreneurs' networks, and as a crucial factor to new venture performance.

Bibliometric analyses showed an increasing interest in AC in the context of new firms. In spite of the earliest paper being published in 2001, the main concepts (which currently prevail) were proposed during the decades of the 1990s (Cohen & Levinthal, 1990; Grant, 1996; Kogut & Zander, 1992; Lumpkin & Dess, 1996) and the early 2000s (Zahra & George, 2002). We identify three inter-related clusters of research regarding the importance of AC in the new venture context: knowledge, innovation, and performance. The relationship between the clusters reflects how firms employ and develop their AC in order to identify and transform new knowledge into innovation projects, which in turn leads to performance improvement and growth.

Content analysis revealed three main concerns related to knowledge obsolescence: growth and dynamic environment and markets, entrepreneurial opportunities, and internationalization. Firms can apply several strategies, internal or external, in order to acquire knowledge, and also might follow both formal and informal processes to address the strategies.

Regarding future research, we identify three avenues exhibit in Table 4. The first avenue contemplates AC from the individual perspective to follow the multilevel approach set by some management areas, which started with

the firm level, business unity, project, and ended on an individual level (e.g., uncertainty management; Gomes et al., 2019). The second avenue centers on bibliometric analysis and literature reviews aiming to identify pivotal studies, which have changed or incorporated content into the AC literature. Finally, the third avenue is related to the strategies for knowledge acquisition in order to clarify the conflicting aspects identified in our content analysis.

Table 4. New avenues for future research

Avenues for future research	Potential research questions
The individual perspective	<ul style="list-style-type: none"> • Which are the micro-foundations and individual cognitive aspects associated with AC and knowledge renewal? • Which mechanisms can contribute to the enhancement of AC? For instance: <ul style="list-style-type: none"> • Exposure to new experiences • Involvement with different areas of knowledge • Access to education and training programs
Bibliometric analysis and literature review	<ul style="list-style-type: none"> • How has the AC concept evolved, and which are the pivotal studies that have changed or incorporated content to the AC literature?
Strategies for KA	<ul style="list-style-type: none"> • Which are the barriers and constraints for KA during the different stages of the startup formation? • What is the effect of the type of strategy for KA (internal or external) on the degree of radicalness of the innovations of the startups? • What is the relationship between the type of strategy for KA and the appropriateness for determining the problem (customer concerns) or the solution (product concerns)?

In addition, we identify some suggestions from the literature: empirical research for validating models or propositions, considering larger samples, longitudinal analysis, different sectors, cultures, and regions. Furthermore, the authors propose to conduct further studies analyzing the types of networks, the interdependencies between the innovation strategies, public policy on innovation, and incorporating different measures of AC.

We contribute to the innovation and entrepreneurship literature in different ways. First, we have connected the importance of AC and new venture creation, to provide a better understanding of how entrepreneurs could enhance their innovative processes. Second, we have established an overview of the existing literature on AC in startups, highlighting the main authors and drivers. Third, we have clustered the pertinent literature with distinct research themes regarding the entrepreneurial AC found in our systematic review and have also proposed a framework that differentiates

knowledge acquisition strategies for new ventures. Finally, we have suggested future research opportunities on entrepreneurship and absorptive capacity.

The results also allow us to identify some practical implications. The analyzed literature suggests that there are certain strategies that entrepreneurs may adopt in order to acquire and absorb new knowledge. We categorize these strategies according to the knowledge source (i.e., internal or external) and the degree of intentionality (i.e., formal or informal). This effort is aimed at persuading entrepreneurs and practitioners to bear in mind a wide range of strategies that mediate between acquiring knowledge and achieving growth objectives and expansion into new markets.

Finally, some limitations must be considered regarding the systematic literature review method. First, concerning the sampling procedures, the keyword selection, which includes only articles published in English and databases from one specific scientific citation indexing service, can limit the resulting sample. In addition, there is some subjectivity involved in the selection of articles for analysis; this is mainly because it relies on the authors' interpretations from reading titles and abstracts. Furthermore, the concept of startups is not very precise. We noticed that it still remains ambiguous and unclear since it is defined differently among the authors. Therefore, it can be difficult to filter the sample in order to restrict the analyses to one specific type of firm.

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Appendix A. Coding process of the three clusters of research guidelines

Knowledge cluster

AUTHORS	YEAR	JOURNAL	TYPE	AIM OF RESEARCH	RELEVANCE OF AC	METHODOLOGY	SAMPLE	VARIABLES	FINDINGS	FUTURE RESEARCH AGENDA
Mueller	2006	RESEARCH POLICY	Empirical article	To understand the role of entrepreneurship and university-industry relations to acquire new knowledge to contribute to regional economic growth.	To identify, capture, and exploit new knowledge.	Cobb-Douglas production function. Panel data cross-sectional time series.	West German region (institutions, universities, new ventures, and firms).	Dependent: Knowledge related entrepreneurship (startups). University-industry relations (grants, spillovers, spinoffs). Independent: Economic Performance.	There is a positive relationship between a well-developed regional knowledge stock and regional economic performance. Regions with a higher level of entrepreneurship (especially in innovative industries) experience greater economic performance. Universities are a source of innovation.	Research visibility of universities' relevance to regional growth. Studies on public policy on innovation
Zahra et al.	2009	JOURNAL OF BUSINESS VENTURING	Conceptual article	How threshold companies (the intermediate stage between startup and established companies) develop new capabilities to improve performance.	AC has two major functions: wealth creation and protection of shareholders' interests. AC allows threshold companies to convert their knowledge into products, goods, and services that create wealth.	Literature review	–	–	To develop AC requires sustained investments in human resources, infrastructure, and research programs. Managerial accountability and AC can sometimes substitute for each other while being complementary.	Follow-up with empirical research to validate the propositions proposed, incorporating measures of managers' skills and environmental conditions. To examine the potential interactions between managerial accountability and absorptive capacity at different thresholds of firms' evolution.
De Clercq et al.	2012	JOURNAL OF BUSINESS VENTURING	Conceptual article	To provide an evaluative overview and evaluation of published research on the roles of learning and knowledge in early new ventures internationalization.	To capture new knowledge based on the preexisting knowledge in outcomes of early internationalization.	Systematic Literature review	48 relevant articles published between 1994 and 2010.	–	Vicarious and congenial learning appear to play a central role in the internationalization process. Search is probably the leading KA type to enhance the post-entry performance. A new venture may be better able to absorb new foreign knowledge when it possesses an extensive knowledge base.	Further studies regarding the individual learning level, center on explaining how a venture realizes learning advantages when internationalizing.
Acis et al.	2009	SMALL BUSINESS ECONOMICS	Empirical article	To develop a knowledge spillover theory of entrepreneurship to improve the microeconomic foundations of endogenous growth models.	To acquire new knowledge.	Longitudinal panel study. F-tests, regression techniques, fixed effect panels.	Startups data from World Bank across 1997-2004 from 19 countries.	Dependent: Entrepreneurship Independent: Knowledge stock, R&D exploitation by incumbents. Barriers to entrepreneurship.	Entrepreneurial activity does not involve only the creation and the management of opportunities, but also the exploitation of knowledge not capitalized by incumbent firms.	Expand the explanation about where opportunities come from, how intra-temporal knowledge spillovers occur, and the dynamics of occupational choice leading to the new firm formation.
Prashantham and Young	2011	ENTREPRENEURSHIP THEORY AND PRACTICE	Conceptual article	To answer what explains differential internationalization speed among international new ventures, after their initial entry into international markets?	AC allows knowledge creation and utilization that enhances a firm's ability to gain and sustain a competitive advantage.	Literature review	–	–	The pace of internationalization varies according to new ventures' capabilities in accumulating and utilizing knowledge through exploitative learning. Social capital could facilitate AC.	Empirical research in order to validate the propositions suggested incorporating moderators and confounding factors such as knowledge-intensity of the industry and firm, firm-specific factors, and home country effects.
Bruneel et al.	2010	STRATEGIC ENTREPRENEURSHIP JOURNAL	Empirical article	To address how firms can accumulate the knowledge and skills required for successful international expansion and how young firms may compensate for their lack of firm-level international experience by utilizing other sources of knowledge.	Facilitates future learning of new and related knowledge.	Survey, multiple regression, and sensitivity analyses.	114 young, technology-based firms in Flanders, Belgium.	Dependent: Extent of internationalization. Independent: Experiential learning, inter-organizational learning, Congenial learning.	The firm's experience in a determined international market negatively moderates the effects of congenial and inter-organizational learning. The lower the startup's experiential learning, the more the effects of the team's prior international knowledge base and skills obtained by key partners.	To conduct other empirical researches with larger samples in other regions and industries, and also longitudinal studies to analyze the dynamics of learning and internationalization.

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Fernhaber et al.	2009	STRATEGIC ENTREPRENEURSHIP JOURNAL	Empirical article	To develop a knowledge-based model of internationalization to investigate the role of external sources of international knowledge	AC is recognized as an organizational mechanism for integrating internal and external sources of knowledge.	Longitudinal panel study. Internal regressions and correlations.	206 U.S. high technology new ventures between 1996-2000.	Dependent: New venture internationalization Independent: Alliance partner int'l knowledge. Venture Capital int'l knowledge. Proximal firm int'l knowledge	External sources are positively associated with a startup's level of internationalization. The nature of external sources of international knowledge depended on the international knowledge of the new venture's team.	Additional tests using other samples, and comparing new and mature firms to analyze the differences. To include the international entry year as a control variable. And to examine how external sources of knowledge impact a new venture's country location decision, taking into consideration country differences.
Yu et al.	2011	STRATEGIC MANAGEMENT JOURNAL	Empirical article	To examine the role of networks in accelerating new venture sales into foreign markets	To help young ventures to learn new knowledge in foreign markets	Longitudinal panel study. Cox proportional hazard models, regressions, and correlations. Kaplan-Meier analysis.	Longitudinal dataset of 118 new ventures in the U.S (1990-2000).	Dependent: Venture initiation of foreign sales. Independent: Technology expertise of technology alliance partners. Marketing alliances with foreign firms. Marketing alliances with internationally experienced startups.	Knowledge derived from ventures' technology and marketing alliances increases the likelihood that startups exploit opportunities in international markets. The probability of a startup initiating foreign sales may be altered by the technological and marketing relationships and by the time required for process knowledge and to exploit international opportunities	New empirical studies considering other high-tech industries, environments, and characteristics. To study how a venture's alliance network influences its degree and scope of internationalization through longitudinal analyses.
Bingham, and Davis	2012	ACADEMY OF MANAGEMENT JOURNAL	Conceptual article	To understand whether the distinct learning processes that organizations use (e.g., trial-and-error learning, vicarious learning, experimental learning, and improvisational learning) combine over time in ordered ways.	To identify and capture new knowledge.	Theory-building (Eisenhardt, 1989) and theory elaboration methods (Lee, 1999). Semi-structured interviews. Case-study	9 entrepreneurial firms with headquarters in Singapore, the U.S., and Finland.	--	Learning sequences (LS) exist, evolve, and are influenced by initial conditions. LS have 2 patterns: seeding and solving. These 2 patterns vary across firms, and the team's international experience influences their adoption.	Empirical studies with a broader sample.
Sullivan and Marvel	2011	JOURNAL OF MANAGEMENT STUDIES	Empirical article	The article examines how an entrepreneur's acquisition of different types of knowledge and reliance on their network for knowledge relate to outcomes of product/service innovativeness and first-year venture sales.	AC allows entrepreneurs to understand, assimilate, and apply new knowledge more effectively.	Survey, OLS regression, sensitivity analyses, hierarchical moderated regression analysis, test of the slopes.	151 venture founders from 16 technology incubators in the USA.	Dependent: First-year venture sales. Product/service innovativeness. Independent: Knowledge acquisition. Moderator: Network reliance on acquiring technology and market knowledge.	Acquiring technology knowledge positively affects the innovativeness of a new venture. Entrepreneurs' network reliance on networks for technology knowledge acquisition.	To conduct other empirical researches with larger samples in other regions. Expand the understanding of the type of networks' reliance and the potential AC.
Agarwal et al.	2010	STRATEGIC ENTREPRENEURSHIP JOURNAL	Conceptual article	To develop implications of the link between knowledge spillovers and strategic entrepreneurship and identify key topics, themes, and issues for future research.	The ability to identify and value new ideas, including those of supply-side agents.	Literature review	--	--	Knowledge spillovers and strategic entrepreneurship are linked to each other, and examining this relationship is important to understand the causes and consequences of value creation and appropriation, diffusion of knowledge, growth, and prosperity of regions and nations.	To research impact on knowledge spillovers and strategic entrepreneurship within and across organizational contexts, the underlying mechanisms that relate knowledge spillovers and strategic entrepreneurship (among other research questions)
Mueller	2007	SMALL BUSINESS ECONOMICS	Empirical article	To identify whether or not entrepreneurship is an important vehicle for knowledge flows and economic growth.	To identify, capture, and exploit new knowledge.	Longitudinal panel study. Cobb-Douglas production function and regressions.	74 planning regions in West Germany (1990-2002).	Dependent: Regional economic growth. Independent: Entrepreneurship, Knowledge creation.	A strong regional knowledge stock is central to economic growth. New knowledge in private firms is more likely to be converted into new products or services. However, research in public organizations is often characterized by basic research which is very important for the regional and national knowledge stock.	Empirical studies with a broader sample.
Knockaert et al.	2011	ENTREPRENEURSHIP THEORY AND PRACTICE	Conceptual article	To assess how knowledge can be transferred and employed in Science-based entrepreneurial firms (SBEF) in order to enhance its performance.	To identify, use, and transfer knowledge successfully.	Longitudinal inductive case study approach.	9 SBEFs from Inter University Micro Electronics Centre, Belgium.	--	Tacit knowledge is better transferred when a substantial part of the former research team become founders of the new venture.	Further research studying a matched sample of SBEFs in the early stages that failed and succeeded in order to compare them and to identify which specific types of tacit knowledge is crucial to enhance SBEF performance.

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Qian and Acs	2013	SMALL BUSINESS ECONOMICS	Conceptual article with empirical evidence	To propose a better understanding of how entrepreneurial activity builds knowledge.	To allow entrepreneurs to understand new knowledge, recognize its value, and commercialize it.	Literature review, Correlation matrix, path analysis, regressions.	Patent data from the U.S. Patent and Trademark Office, 305 MSAs/PMSAs	Dependent: New knowledge. Entrepreneurship. Independent: Human capital. New knowledge.	Knowledge spillover entrepreneurship depends on new knowledge and entrepreneurial AC (EAC), defined as the "ability of an entrepreneur to understand new knowledge, recognize its value, and subsequently commercialize it by creating a firm"	Additional empirical work using an individual unit of analysis (surveys with entrepreneurs).
Tolstoy	2009	JOURNAL OF SMALL BUSINESS MANAGEMENT	Empirical article	To investigate the prospective impact network knowledge and knowledge combinations have on entrepreneurial firms' knowledge creation.	It is the mechanism by which firms identify, acquire, and exploit new knowledge.	Survey, Structural equation model, using linear structural relations (LISREL).	Random sample of 188 international SMEs from Sweden Business Register	Dependent: Knowledge creation. Knowledge combination. Independent: Dependence on customer knowledge. Dependence on supplier knowledge.	Knowledge combination is a predominant activity to enable knowledge creation in foreign markets. In order to create commercial products and services, firms must constantly rewrap knowledge by combining it in new ways.	Further investigation regarding the processes involving knowledge combination and knowledge creation in foreign-market networks of international entrepreneurs, and the cost of creating knowledge in external networks rather than in a firm's internal network.
Hayton and Zahra	2005	INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT	Empirical article	To examine the extent to which the AC of high technology new ventures is influenced by the human capital characteristics of their top management teams (TMT).	AC is the ability to identify, acquire, assimilate, and exploit new knowledge.	Survey, Hierarchical regressions, and correlations.	340 high technology new ventures from the USA.	Dependent: Innovation. Financial performance. Independent: Venturing. Human capital.	Human capital diversity of the TMT moderates the relationship between venturing activities, innovation, and financial performance. The diversity of the TMT in terms of both functional experience and formal educational background can enhance the acquisition and exploitation of new knowledge.	To consider alternative indicators of human capital of top management and to examine the roles of the TMT characteristics in organizational learning from venturing activities.
Hayter	2013	SMALL BUSINESS ECONOMICS	Conceptual article	To answer the question: what is the role of networks in encouraging and supporting knowledge-based entrepreneurship?	To identify, capture and exploit new knowledge	Literature review	--	--	The ability of an entrepreneur and an entrepreneurial firm to take advantage of the information and resources provided by a network is determined by their internal capability to do so. From the knowledge-spillover perspective, networks provide resources and support the knowledge, but few empirical studies exist relating to entrepreneurship.	To develop more empirical research relating to knowledge-spillover and entrepreneurship. Studies to examine the relationship between the content and nature of networks and entrepreneurial outcomes such as firm establishment, performance, and evolution.
Carayannis et al.	2011	IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT	Empirical article	To examine the roles of knowledge acquisition and transformation in regional sustainability of new venture formation.	The means by which new venture founders incorporate new knowledge into their organizations.	Agent-based simulation, 30 runs of the simulation in six configurations. F-statistics.	--	Dependent: New venture formation. Independent: Formal knowledge acquisition. Serendipitous knowledge transformation.	Formal knowledge acquisition is more effective in knowledge-scarce regions, while informal knowledge acquisition and serendipity are more appropriated for new venture formation in knowledge-rich regions.	Empirical tests to validate the models and to analyze the rate and quality of new venture dynamics
Patton	2014	INTERNATIONAL SMALL BUSINESS JOURNAL	Empirical article	To analyze the incubation process through the lens of AC in order to evaluate how it might strengthen the business model of new technology firms.	AC enables knowledge development and critically, facilitating the transformation of knowledge into a resource which supports business development and sustainability.	Case study	27 new firms at two University incubators at Southampton and Bristol between 2009 and 2011.	--	The interaction between incubator directors, mentors, and business support agents enables experiential and exploitative learning, which are the precursors of knowledge accumulation.	Future research needs to investigate how the incubation process creates a context which encourages founders to engage with those who can assist the accumulation of the knowledge to develop a commercial business model.
Perez et al.	2013	EUROPEAN JOURNAL OF MARKETING	Empirical article	To gain a better understanding of how small technology start-ups learn about a key customer in the context of B2B relationships, and to propose a model of interfirm learning with customers	The ability of a firm to recognize the value of new, external information, assimilate, and apply it to commercial ends and enhance innovative performance.	Qualitative case-based approach over two to three years.	Three cases of alliances to develop new products or technologies between a young technology firm and a large, well-established customer.	--	A similar knowledge base affects positively the new venture's ability to learn about customers. Learning-by-interacting is beneficial for technology start-ups to access new markets and new resources to develop innovative solutions that could not have been developed alone.	Further research using large-scale longitudinal studies and considering the effect of inter-firm market orientation on performance and innovation.

AUTHORS	YEAR	JOURNAL	TYPE	AIM OF RESEARCH	RELEVANCE OF AC	METHODOLOGY	SAMPLE	VARIABLES	FINDINGS	FUTURE RESEARCH AGENDA
Friesl	2012	BRITISH JOURNAL OF MANAGEMENT	Empirical article	To delineate the relationship of activity configurations for knowledge acquisition and company performance.	AC helps firms to identify, acquire, and use knowledge that affects firms' performance and innovativeness.	11 semi-structured interviews. Survey, 88 CEOs. Multiple regressions and correlations analysis. ANOVA.	Young biotechnology companies in Germany.	Dependent: Performance. Independent: Knowledge acquisition strategies.	There are four knowledge acquisition strategies for knowledge acquisition and performance: low key, mid-range, focus, and explorer. Knowledge acquisition strategies that show a high intensity and that combine both complementary and supplementary knowledge acquisition are linked to higher levels of company performance.	To conduct other empirical researches with larger samples in other regions and with a greater number of respondents. New studies aiming to investigate how young companies actually orchestrate knowledge acquisition in practice.
Moon	2011	ASIAN JOURNAL OF TECHNOLOGY INNOVATION	Empirical article	To examine the factors that influence a firm's openness to external sources of knowledge in the Korean service sector.	To recognize the value of new, external information, assimilate it, and apply it to commercial ends.	Survey. Negative binomial regression, correlations, Tobit regression.	2498 Korean service new firms	Dependent: Degree of openness to external knowledge sources. Independent: Overall tightness of appropriability of a firm. The share of employees with graduate degrees. Whether a firm is a startup. Firm size.	The appropriability strategy, the share of employees with graduate degrees, being a startup, and firm size seem to be major determinants of the openness to external knowledge sources in Korean service industries. The use of intellectual property rights may not be effective in enhancing the openness to external knowledge in Korean service industries, it may eventually restrict the incentive to use external knowledge.	To develop the measures of AC in terms of human capital and skill and to compare the determinants of openness in the manufacturing and service sectors.
Carayannis et al.	2016	JOURNAL OF TECHNOLOGY TRANSFER	Empirical article	To examine the influence of the new venture, the entrepreneur's social capital, and the firm performance on the new venture's knowledge acquisition activities.	The means by which new venture founders incorporate novel knowledge into their organizations.	Simulation methodology. 3 runs in 3 configurations. Statistical analysis, regressions, ANOVA, Post-hoc Bonferroni tests.	-	Dependent: Regional rate. Independent: Level of new venture formation.	The increase in the firm's knowledge acquisition has a positive impact on the survival of new ventures and the sustainability of entrepreneurship in a region.	To develop and test more realistic scenarios in the simulation, and qualitative and quantitative researches.
McKelvie et al.	2018	ENTREPRENEURSHIP THEORY AND PRACTICE	Empirical article	To address how perceptual differences of environmental dynamism explain differences between external and internal knowledge development for the continuous innovative efforts in new ventures.	The ability of a firm to acquire new knowledge.	Survey. Harmon's one-factor test. Hierarchical linear regression, correlations, and robustness test.	316 new ventures in the TIME sector in Sweden.	Dependent: New venture innovation. Independent: External market knowledge acquisition. Internal knowledge generation. Market dynamism and Technological dynamism.	The newer ventures invest in capturing knowledge from the external knowledge, the more likely they are to continue their entrepreneurial activities and develop more new products. New ventures within the same industrial sector have different perceptions about the market and technological dynamism, these perceptions are important for understanding knowledge development processes.	New studies using longitudinal design or panel approach in order to capture temporal differences in the length of time. Future researches involving decision making.
Dai et al.	2018	JOURNAL OF MANAGEMENT STUDIES	Empirical article	To examine how new ventures access and use knowledge from different external sources, and gauge the influence of these efforts on their strategic flexibility.	A mechanism for firms to acquire and integrate diverse and non-redundant knowledge.	Survey, ANOVA, correlations, multiple regressions. Aiken and West's (1991) procedure to decompose the interaction terms.	148 high-tech ventures in the Yangtze River Delta, China.	Dependent: Strategic flexibility. Independent: NPJ alliances. Loosely coupled external sources of knowledge. Moderator: Decentralization. Institutional support.	In new ventures, decentralization of decision-making and institutional support enhances knowledge integration. There are 2 ways in which new high-tech ventures may improve their strategic flexibility: by accessing information and knowledge, and new product development allancing.	Further research employing a longitudinal design with the use of archival data. New empirical studies considering other high-tech industries, environments, and characteristics.
Saemundsson and Candi	2017	TECHNOVATION	Empirical article	To investigate relationships between knowledge and opportunities in new ventures and how potential AC is related to the identification of opportunities in new technology-based firms (NTBFs).	To acquire, assimilate (potential AC), transform and exploit (realized AC) knowledge for innovation	Survey collected twice, one year apart. Three-step Hierarchical regression analysis, correlations, interaction diagrams.	94 NTBFs in Northern Europe	Dependent: Entrepreneurial opportunities. Independent: Problem absorptive capacity. Solution absorptive capacity.	Changes in problem AC were a stronger trigger for new opportunities identification than changes in solution AC.	More work is needed to improve measures of AC and to better understand the sources of the solution, problem and realized AC.

Innovation cluster

AUTHORS	YEAR	JOURNAL	TYPE	AIM OF RESEARCH	RELEVANCE OF AC	METHODOLOGY	SAMPLE	VARIABLES	FINDINGS	FUTURE RESEARCH AGENDA
Dushnitsky, G; Lenox, MJ	2005	RESEARCH POLICY	Empirical article	Do firms that invest corporate venture capital (CVC) learn about and appropriate new technologies and practices from those ventures in which they invest?	The greater a firm's AC, the greater the marginal impact of CVC investment on firm innovation rates. The greater a firm's AC, the greater a firm's investment in entrepreneurial ventures will impact the firm's innovation rate.	Longitudinal panel study	2289 public firms that invested corporate venture capital or patented during 1969-1999.	DIV: patent citations, IV: R&D Expenditures, negative binomial specification with the firm, sector, and year fixed and random effects and lagged independent variables.	The authors found that increases in CVC investment are associated with subsequent increases in future citation-weighted patenting rates. Furthermore, the magnitude of this effect depends on the firm's AC and the strength of intellectual property protection.	Future studies using other measures of AC (such as R&D expenditure).
Dushnitsky, G; Lenox, MJ	2005	STRATEGIC MANAGEMENT JOURNAL	Empirical article	What are the conditions in which firms are likely to pursue equity investment in new ventures as a way to source innovative ideas?	The greater a firm's cash flow and AC, the more likely it is to invest in new ventures.	Longitudinal panel study	1171 U.S. public firms during the period 1990-1999 60,444 firm-year-sector observation.	DIV: annual Firm CVC investment in ventures IV: Firm Sector CVC, Tech, Opportunity, IP Regime, Complementary Assets Importance, Firm Cash Flow, Firm Patent Stock, Technological proximity, Firm Advertising, Firm Internal R&D, Firm Sue.	Ventures in industries with weak intellectual property protection and where complementary distribution capability is important are more likely to receive CVC. Cash flow has a positive effect on equity investment. Firms with greater AC are more likely to invest in new ventures.	Further researches aiming to analyze the latent interdependencies among the innovation strategies (e.g. internal R&D and CVC).
Wadhwa, A; Kotha, S	2006	ACADEMY OF MANAGEMENT JOURNAL	Empirical article	The study investigated the conditions under which CVC investments affect knowledge creation for corporate investors. What are the limits to knowledge creation from CVC investments? And when are these limits likely to manifest?	Access to new information through CVC improves the AC. However, there are limits to the amount of new knowledge that an investment company can absorb.	Longitudinal panel study	Telecommunications equipment manufacturing industry between 1989-1999, and Venture Xpert, the official database of the National Venture Capital Association 36 corporate entities 383 firm-year observations.	DIV: successful patent applications for a firm in a year. IV: number of CVC investments; corporate investor's involvement; technological knowledge diversity CV: prior joint ventures, alliances, and mergers and acquisitions; prior patent stock of firm; firm age; knowledge relatedness between the investor and portfolio firms; the number of venture capitalists.	When investor involvement is low, the number of CVC investments has an inverted U-shaped relationship with innovation performance. When investor involvement is high, the relationship reverses, and an increase in investments boosts innovation.	Investigate other industries; examine why technological diversity did not moderate the relationship between CVC investments and innovation.
Filatovchev, I; Liu, XH; Wright, M	2011	RESEARCH POLICY	Empirical article	What is the impact of returnee entrepreneurs and their knowledge spillovers on innovation in high-tech firms in China?	AC moderates the innovation promoted by returnee entrepreneurs.	Longitudinal panel study	1318 high-tech firms in Beijing Zhongguancun Science Park between 2000-2003	DIV: The number of patents per employee of the firm; the proportion of sales from new products IV: Skill intensity; Returnee spillovers; MNE's R&D activities CV: in-house R&D; firm age; firm size; ownership; export intensity; imported technology; industry R&D intensity.	Returnee entrepreneurs create a significant spillover effect that promotes innovation in other local high-tech firms that is moderated by the non-returnee firm's AC.	To compare the efficacy of the knowledge brought by returnee entrepreneurs versus the resources and knowledge of multinational enterprises in stimulating the development of emerging economies.
McAdam, M; McAdam, R; Galbraith, B; Miller, K	2010	R & D MANAGEMENT	Empirical article	What is the role and influence of the Principal Investigator (PI) in the Proof of Concept (PoC) process within a University Science Park incubator setting using an ACAP perspective.	How organizations acquire new knowledge and leverage it to achieve a competitive advantage.	Multiple case analysis of PoC; interpretive research philosophy.	UK university projects	-	PIs had good technical knowledge and ideas for applications but were lacking in commercial awareness and business reality. This lack of commercial awareness was found to be the most significant challenge to increasing ACAP within the USJ through the stakeholders using the PoC's routines and practices.	Mostly managerial recommendations, such as the suggestion that rules regarding ownership of patents and licenses should have more clarification to increase the entrepreneurial motivation of the PI's.

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Winkelbach, A; Walter, A	2015	INDUSTRIAL MARKETING MANAGEMENT	Empirical article	What is the interplay between AC, prior knowledge, and value creation.	AC moderates the interplay between complex knowledge and value creation. ACAP = prior technological knowledge.	Survey. Moderated hierarchical regression.	Database of 127 science-to-industry R&D projects in technology-based markets.	DV: transfer value IV: Knowledge attribute complexity, prior knowledge, absorptive capabilities, absorptive capabilities CV: tie strength, prior partnership experience, and structural characteristics.	Prior knowledge has no significant effect on value creation per se. Instead, the impact of complex technological knowledge on value creation is enhanced at high levels of both prior knowledge and structural characteristics.	Future studies can replicate our research using longitudinal designs, which could eliminate several biases including a potential hindsight bias. Additionally, future studies should integrate the dyadic perspective into science-to-industry technology transfer projects. Finally, it will be worthwhile to analyze our framework in other national contexts because cultural and context-related aspects can increase the influence of specific factors.
McAdam, R; McAdam, M; Brown, V	2009	R & D MANAGEMENT	Empirical article	To explore the Proof of Concept (PoC) process within a University Science Park Incubator as a means for improving the commercialization of University technology transfer using an AC perspective.	Importance of Absorptive Capacity on PoC outcomes.	Multiple case analysis; Interpretive research philosophy; semi-structured interviews.	16 PoC projects;	-	AC influencing factors such as levels of R&D investment, prior knowledge base, and integration of stakeholder and technology planning which impact the PoC outcomes.	Mostly managerial recommendations, such as outsourcing some include more PoC planning measures or programs aiming commercialization.
Marvel, M	2012	JOURNAL OF SMALL BUSINESS MANAGEMENT	Empirical article	Explore knowledge acquisition asymmetries in early venture development and how they are related to innovation creation.	AC as a control variable: aspects of prior knowledge and experience may relate to AC and the development of radical offerings.	Survey	166 founders of new technology ventures in university incubators	IV: Knowledge Acquisition. DV: Innovation Radicalness. Control Variables: nature of the venture's offering, experience depth, formal education, experience breadth, and physical sciences/engineering education.	Asymmetries in knowledge acquisition during early venture development are vital to innovation creation. Innovation radicalness was positively associated with acquiring knowledge of customer problems and markets. Acquiring knowledge of ways to serve markets was negatively associated with innovation radicalness. The fewer technology entrepreneurs know about comparable offerings in the market and how to develop them, the greater their chances of creating breakthrough innovations.	Future studies are encouraged to explore the multidimensional nature of knowledge and learning in explaining opportunity discovery, exploitation, and venture outcomes
Monferrer, D; Blesa, A; Ripolles, M	2015	EUROPEAN JOURNAL OF INTERNATIONAL MANAGEMENT	Empirical article	How market-orientated networks contribute to the development of adaptive, absorptive, and innovative knowledge-based dynamic capabilities in international new ventures (INVs)? (market orientation is defined as a strategic orientation established jointly by the different members in the business relations network)	The participation of INVs in market-orientated networks encourages their AC. Network market orientation makes a significant contribution to the development of AC in INVs.	Survey; structural equations modeling	303 firms founded after 2005 and with international activity	Variables: market orientation of the network and dynamic capabilities of the firms	The study shows the utility of the network market orientation construct. Knowledge derived from the firm's market-oriented networks, helps the firms to develop dynamic capabilities in order to act sustainably in their international markets.	Future studies that continue to analyze factors that can explain the international competitiveness of INVs.
Kamuriwo, DS; Baden-Fuller, C; Zhang, J	2017	JOURNAL OF PRODUCT INNOVATION MANAGEMENT	Empirical article	What are the coordination mechanisms, models, and approaches that are most effective at producing breakthrough innovations?	Search capabilities and AC of partners can be used when TBM's are undertaking fundamental research.	Longitudinal panel study	69 UK new biotechnology firms over 11 years.	DV: number of the firm's patents that turned out to be a breakthrough innovation; product development rate IV: Knowledge development made. CV: funds, VC backing, public stock listing, number of employees, number of alliances, technology type, therapeutic categories	External knowledge-development mode is associated with more breakthrough innovation and a faster movement of innovations to market.	Future studies will need to model the firms' choice of knowledge development modes directly and the antecedents to the knowledge development.

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Lee, SM; Kim, T; Jang, SH	2015	MANAGEMENT DECISION	Empirical article	To identify the circumstances under which CVC investment facilitates knowledge transfer from startups to investing firms	AC plays a critical role in facilitating knowledge transfer across organizations	Longitudinal panel study	29 investor firms that invested in entrepreneurial firms at least once during 1995-2005	DV: Amount of knowledge transferred through CVC investment IV: the number of CVC investments CV: Age/Size of the corporate investor; R&D intensity; Industry relatedness; Corporate investor's stock of patents; Economic cycles MV: Tie strength of CVC program; Knowledge diversification of the corporate investor	The relationship between the CVC investment and the level of knowledge transfer either diminishes or results in negative returns. The authors found out that corporate investors need a proper mechanism of knowledge transfer if they are to maximize the innovative outcome of CVC investment.	Future studies analyzing different regions and different environmental settings that may influence the design of CVC programs and their effects on knowledge transfer from the start-up to the investing firm. Additionally, a much wider range of time span should be used to examine the effect of CVC investment.

Performance cluster

AUTHORS	YEAR	JOURNAL	TYPE	AIM OF RESEARCH	RELEVANCE OF AC	METHODOLOGY	SAMPLE	VARIABLES	FINDINGS	FUTURE RESEARCH AGENDA
WRL, P	2004	ENTREPRENEURSHIP AND REGIONAL DEVELOPMENT	Conceptual article	How entrepreneurial network activities can be measured and which indicators exist to quantify start-up success. What is the relationship between entrepreneurial networks and start-up success.	Networking abilities influence the AC of founders. Entrepreneurs will not be able to benefit from co-operations and information from network partners if they do not possess the necessary knowledge and the capacity to absorb the information in their own organization.	Theoretical Essay / Literature Review	--	--	The study reveals that the major shortcomings of existing network studies are found to be the neglect of different starting conditions, the focus on individual founders' networks instead of multiple networks in start-ups with an entrepreneurial team, and the assumption of a linear causal relation between networking and start-up success.	Future research studying the dynamics of networks, changes in network utilization, and measurable definitions for the different network types.
Zahra, SA; Hayton, JC	2008	JOURNAL OF BUSINESS VENTURING	Empirical article	Does the AC moderate the relationship between international venturing and company performance?	the importance of AC for achieving profitability and growth over international acquisitions and alliances.	Hierarchical regression modeling	217 global manufacturing firms	DV: profitability and revenue growth IV: international acquisitions and international alliances moderated by AC	AC moderates the relationship between international venturing and firms profitability and revenue growth.	It would be useful to document the various types of knowledge a firm might gain from international venturing and the specific types of knowledge associated with various approaches to international venturing
Deeds, DL	2001	JOURNAL OF ENGINEERING AND TECHNOLOGY MANAGEMENT	Empirical article	What is the relationship between a high technology venture's R&D intensity, technical capabilities and AC, and the amount of entrepreneurial wealth created by the venture?	AC is positively related to the amount of entrepreneurial wealth created by the venture.	Longitudinal panel study	80 pharmaceutical biotechnology companies, which went public between 1982 and 1993	DV: MVA (Market value added) IV: Research and development intensity; Technical development capability; Absorptive capacity CV: Hot markets, Number of employees	There is a positive relationship between a high technology venture's R&D intensity, late stage technical capabilities and AC, and the amount of entrepreneurial wealth created by a high technology venture.	Studies of entrepreneurial wealth creation in other technology and industry contexts in order to expand understanding. Further studies about the relationship between the R&D intensity, technical development capabilities and AC, and other measures of a high technology venture's performance, such as survival, growth, profitability, etc.
Benson, D; Ziedonis, BH	2009	ORGANIZATION SCIENCE	Empirical article	What are the beneficial effects of CVC investing on acquisition performance?	Information gained through CVC investing can be useful, but internal technological capabilities remain a critical determinant of success in innovation-driven acquisitions.	Longitudinal panel study	34 CVC investors in the IT sector that acquired a total of 273 startups between 1987 and 2003	DV: Acquisition Performance IV: CVC intensity, Stability, Consecutive years investing in CVC, total years investing in CVC CV: Characteristics of the Acquirer, Characteristics of the Target and the Deal	As CVC investments increase relative to an acquirer's total R&D expenditures, acquisition performance improves at a diminishing rate. Firms consistently engaged in venture financing earn greater returns when acquiring startups than do firms with more sporadic patterns of investing, even controlling for firm profitability, size, and acquisition experience.	Future research should engage in utilizing more direct measures of a corporate investor's "reputation" within the external venture capital and startup communities. The authors suggest the following questions: Do CVC investors in the IT sector "learn more" from innovative startups because of the inability of startups and investors to safeguard technological know-how from expropriation? Are CVC investors in IT more actively seeking out innovative young companies as acquisition targets in response to competitive pressures within the industry?

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Newey, LR, Zahra, SA	2009	BRITISH JOURNAL OF MANAGEMENT	Empirical article	How collaborating companies use AC processes at operating and dynamic capability levels?	The authors propose AC as a key knowledge-based mechanism linking learning to product development and portfolio planning.	Case study, Interviews with 12 key informants	2 biotech companies	-	At the operating capability level, firms build AC in value networks during their product development experiences and this learning needs to be captured at the product portfolio planning level. Then, product portfolio planning acts as a dynamic capability reconfiguring operating capabilities based on beliefs about follow-on entrepreneurial opportunities. Under conditions of endogenous change, dynamic capabilities are guided by a proactive entrepreneurial logic, complementing the need for reactive adaptive responses in circumstances of exogenous change.	Future research could consider how interactions between portfolio planning and product development enables/constrains the AC of the organization in the face of exogenous shocks. Additionally, studies aiming to understand the traps associated with value network, AC as a linking mechanism between dynamic and operating capabilities, and how firms need to build their portfolio planning capabilities to better prepare for and/or limit the adverse impacts of exogenous shocks. Future researchers might engage a longer longitudinal study that tracks the interaction between these capability sets over multiple product development experiences and the resultant revisions that occur to the product portfolio.
Clarysse, B, Wright, M, Van de Velde, E	2011	JOURNAL OF MANAGEMENT STUDIES	Empirical article	How different characteristics in the technological knowledge base at start-up influence spin-off performance?	Importance of the knowledge in the same domain as the parent (university/corporate) for spin-off's growth.	Longitudinal panel study	48 corporate and 73 university spin-offs, comprising the population of spin-offs in Flanders during 1991-2002.	DV: venture growth IV: Scope, Necessity, Tacitness, Relatedness CV: firm age, number of employees, start-up capital of the spin-off, technological domain (industry)	Corporate spin-offs grow most if they start with a specific narrow-focused technology sufficiently distinct from the technical knowledge base of the parent company and which is tacit. The novelty of technical knowledge does not play a role in corporate spin-offs but has a negative impact on university spin-offs unless universities have an experienced technology transfer office to support the spin-off.	Expand the research to other geographical regions, incorporating different institutional contexts; conduct a longitudinal design detailing the changes in the scope of technology; research the role of social capital and networks provided by the parent organization or considered the nature of the relationship with the parent organization.
Wales, WJ, Parida, V, Patel, PC	2013	STRATEGIC MANAGEMENT JOURNAL	Empirical article	What is the nature of the relationship between ACAP and financial performance?	AC x Financial performance trade-off	Survey, one-factor analysis	285 Swedish small- to medium-sized enterprises	DV: growth IV: ACAP, EO CV: Firm age, size, productivity growth, equity ownership, geographical focus, market sector	There is indirect evidence associated with ACAP that produces an inverted U-shaped relationship with financial performance and that Entrepreneurial Orientation (EO) may enhance returns to investments in ACAP.	Research on other industry sectors; studies making a direct cost measure.
Simek, Z, Heavey, C	2011	STRATEGIC ENTREPRENEURSHIP JOURNAL	Empirical article	How corporate entrepreneurship (CE) contributes to extending the firm's knowledge-based capital and its performance.	CE enables ACAP of SME enterprises. CE governs firm performance as a dynamic capability by reconfiguring, extending, and modifying the firm's knowledge-based resources	Survey, Confirmatory factor analysis to validate the scales; cross-sectional design	TMTs of 125 firms	DV: Firm performance IV: the firm's pursuit of CE (firm's pursuit of innovation, venturing, and strategic renewal); Knowledge-based capital (human, social and organizational capital)	The pursuit of CE enhances the firm's knowledge-based capital residing in people (human capital), relationships (social capital), and systems (organizational capital). CE is mediated by capital type.	Other studies examining CE effects and the mediator role of knowledge-based mechanisms and performance.
Zheng, YF, Liu, J, George, G	2010	JOURNAL OF BUSINESS VENTURING	Empirical article	How do the effects of innovative capability and inter-firm network attributes on valuation vary with firm age?	A heterogeneous network provides access to diverse information flows and, consequently, provides the opportunity to absorb external information. ACAP is positively influenced by a heterogeneous network.	Longitudinal panel study	170 biotechnology start-ups	DV: Firm valuation IV: Innovative capability CV: Market condition, Biotech firm density, Geographic area, Technological field, Public company, Total alliances, Equity alliances	The relative value of network status declines while the impact of innovative capability increases with firm age. Furthermore, there is a growing complementary effect of innovative capability and network heterogeneity on firm valuation.	The authors suggest the following questions: What happens to the effects on firm valuation in the long run? Does the capability/network effect reach a plateau effect after increasing or declining when routine development and information accumulation reach their equilibrium stage when new routines or information contribute little to firm value? Or do firm capabilities undergo a life cycle with periods of growth and decline?

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Rhee, JH	2008	ASIAN BUSINESS & MANAGEMENT	Empirical article	What are the determinants of entry mode choice and internationalization performance of new ventures?	To match the information-processing requirement inherent in firm internationalization, employees need to have a corresponding information-processing capacity.	Survey	95 Korean venture firms that had international operations	DV: Entry mode, performance IV: Competitive advantages based on technology, Start-up team members' social network, Employees' absorptive capacity CV: Firm size	The results indicate that the AC of employees is not as important as the social networks of start-up team members in determining entry mode in international expansion. Social networks of start-up team members do not help their ventures reap superior performance.	Further theoretical perspectives need to be applied to better understand the internationalization of new ventures.
Nielsen, K	2015	JOURNAL OF TECHNOLOGY TRANSFER	Empirical article	What is the importance of human capital for industry choice and subsequent performance of first-time entrepreneurs?	Individuals with higher levels of education are expected to be better at adapting to a changing environment because of their higher absorptive and learning capacities.	Survey, OLS regressions, ordered logit model (OLM)	1,151 individuals starting new ventures in 133 different industries	DV: New venture performance IV: Human capital CV: Tolerance of ambiguity, Creativity, Social capital, Wealth and initial investment	Technical academics are found to perform better in both profitable and uncertain industries, whereas non-technical academics perform better only in profitable industries. Both types of academics are more likely to enter uncertain industries.	Further research might explore the causes of the differences in performance between technical and non-technical academics in uncertain industry environments with the intention of improving university entrepreneurship policy and education. Exploring the relationship between higher education in different fields of study and the adaptive capabilities, causal/effectual reasoning regarding the start-up process, intrinsic/extrinsic work values, and entrepreneurial opportunity costs would be valuable.
Javalgi, RG; Hali, KD; Cavusgil, ST	2014	INTERNATIONAL BUSINESS REVIEW	Conceptual article	How sales representatives can contribute to or even largely fulfill the research function?	The degree to which AC contributes to producing a meaningful and valuable knowledge advantage for the firm.	Literature Review, Conceptual model	–	–	The authors propose that international sales performance for firms practicing corporate entrepreneurship will be enhanced when salespeople practice customer-oriented selling and the firm's absorptive capacity is stronger.	Empirical testing of the conceptual model. Additional opportunity lies in the investment of the incentive and control structures that would best balance salesperson independence with customer-oriented selling and information sharing.
Un, CA	2011	INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT	Empirical article	How existing capabilities influence new entrepreneurial technological capabilities, and in what way the existing capabilities affect the development of new technological capabilities.	AC enables the development of new knowledge.	Survey	1,215 manufacturing firms operating in Spain	DV: development of new technological capabilities through investments in R&D IV: the capability to invest and the capability to absorb CV: firm's size, experience in business, and industry.	Prior capabilities to invest and to absorb enable the firm to develop new technological capabilities. The capability to absorb affects both types of investment, the capability to invest only affects external investments in R&D.	Further analyses about the origin of the resources and capabilities, how they are developed, and why competitors cannot imitate them.

Abstrakt

Cel: Kilku uczonych wskazało, że zdolność absorpcyjna (AC) ma kluczowe znaczenie dla procesu innowacji w dużych firmach. Jednak wielu innych autorów uważa start-upy za kluczowe czynniki napędzające innowacje w obecnej gospodarce światowej. Dlatego niniejszy artykuł ma na celu określenie, w jaki sposób koncepcja AC została potraktowana w kontekście nowego przedsięwzięcia. **Metodyka:** Systematyczny przegląd literatury analizujący 220 artykułów opublikowanych w latach 2001–2018. **Wyniki:** Systematyczny przegląd literatury identyfikuje trzy grupy badań dotyczących AC w start-upach: wiedza, innowacje i wyniki wraz z głównymi autorami dyskusji, głównymi wkładami, odniesienia teoretyczne i wytyczne dotyczące ich przyszłego programu badawczego. **Implikacje dla teorii i praktyki:** Niniejsze badanie wnosi wkład do literatury dotyczącej innowacji i przedsiębiorczości łącząc znaczenie AC i tworzenia nowych przedsięwzięć oraz zapewniając lepsze zrozumienie, w jaki sposób przedsiębiorcy mogą usprawnić swoje procesy innowacyjne. **Oryginalność i wartość:** Na podstawie analizy przeglądu literatury stworzono ramy różniące strategie pozyskiwania wiedzy dla nowych przedsięwzięć. Ramy kategoryzują strategie według

źródła wiedzy (tj. wewnętrznego lub zewnętrznego) oraz stopnia intencjonalności (tj. formalnej lub nieformalnej).

Słowa kluczowe: *innowacje, chłonność, startupy, nowe przedsięwzięcia, przedsiębiorczość.*

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Conflicts of interest

The authors declare no conflict of interest.

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