External knowledge absorption in Chinese SMEs

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2 Absorptive Capacity Literature Review

This research is dedicated to improving our understandings of three important issues regarding absorptive capacity (AC) of SMEs, which are formulated in three RQs. In summary, they deal with (1) how do SMEs absorb external knowledge in terms of its recognition, assimilation, and utilization? (2) what challenges may they face in the processes? Moreover, (3) which external knowledge assimilation (EKA) mechanisms do have an impact on the performance of SMEs? To investigate the RQs, we introduce the concept of AC as the key theoretic perspective.

This chapter serves two purposes. First, it underpins the AC study by a broader theoretical basis. Second, the chapter is aimed to demonstrate the necessity of investigating the RQs phrased in the introduction chapter. To these purposes, Section 2.1 reviews four theories that we believe underpin the theoretical origin of AC. Moreover, the relationship between AC and the four theories is elaborated upon. Then, Section 2.2 provides a review of essential topics within the existing AC literature. Based on the review, potential knowledge gaps are explored and identified in Section 2.3. The necessity of conducting this study is described accordingly.

2.1 Underpinning the AC Studies

Since its introduction by Cohen and Levinthal (1989, 1990), the concept of AC has become a popular research topic. A simple search of "Absorptive Capacity" in Google Scholar (excluding citations and patents) for the AC studies in the last three decades (1989-2020) returns more than 67 thousand results. About half of them were conducted in the last ten years (from 2010 to 2020).

The AC concept has roots in several well-established concepts and theories, and the concept has been enhanced through re-conceptualizations and extended by various studies. This section introduces the most relevant theoretic perspectives that are distinct yet closely related to AC literature. Subsection 2.1.1 is focused on the resource-based view of the firms. Subsection 2.1.2 reviews the knowledge-based view of the firms. The theory of organizational learning is reviewed in Subsection 2.1.3, followed by

Subsection 2.1.4 that is focused on dynamic capabilities. Subsection 2.1.5 specifies the relationship between these research streams and AC.

2.1.1 Resource-based View

Penrose (1959) is one of the earliest scholars to conceptualize firms as consisting of a collection of resources. He recognizes that internal resources could contribute to a firm's competitive advantages when appropriately used and translated into demanded products and services. Wernerfelt (1984), who explicitly argues that internal resources and product outputs are two sides of a coin, stresses that internal resources at the firm level are the main determinants of sustainable competitive advantages. He suggests that a firm can earn above-normal profits by recognizing, attaining, and developing critical resources. An adequate strategy for a large firm involves achieving a balance between the exploitation of existing resources and the exploration of new ones.

The resource-based view of the firm has earned considerable attention among scholars as a framework for explaining the conditions under which a firm may gain a sustained competitive advantage. In the early strategic management literature, authors generally had given the equal emphasis on internal strengths and weaknesses within a firm versus the opportunities and threats in the external environment (e.g., Priem and Butler 2001). Other scholars have investigated how or why resources contribute to the advantage of one firm over another. For example, Barney (1991) and Barney *et al.* (2001) further articulates that the resource-based view is based on the assumption that endowments and capabilities of different companies are unevenly distributed, and the market is imperfect for resources and capabilities to be freely transferred. Only resources that own specific characteristics are critical to a firm's sustained competitive advantages. These resources must be valuable, rare, inimitable, and no-substitutable. Such resources include a combination of a firm's tangible and intangible assets, such as management scheme, knowledge, capabilities, and organizational procedure.

However, some scholars have pointed out that merely owning specific resources is not enough and critiqued the static nature of the resource-based view (cf. Priem and

Butler 2001, Newbert 2007). These authors advocated that the possession of resources will not bring competitive advantages automatically unless a firm owns competencies to alter and utilize the resources effectively, particularly when the environment is changing. Hence, firms need to develop distinctive capabilities to alter or reconfigure their internal resources, knowledge, and capabilities timely.

So, according to Barney (1991), the resource-based view has two sides. On the one hand, it stresses that knowledge and capabilities are critical organizational resources leading to strategic advantages. On the other hand, it calls for firms to develop unique capabilities to reconfigure their resources purposefully. Thus, the resource-based view of firms is seen by this study as having laid the fundamentals for many new research streams such as knowledge-based view of firms, organizational learning, and dynamic capabilities. These streams, in turn, have influenced the generation of the theory of organizational AC.

From the resource-based view, knowledge is one of the strategic resources (cf. Probst *et al.* 1998, Hult *et al.* 2006, Pee and Kankanhalli 2016). It can be either generated internally or obtained externally. Hence, the AC research coincides with the facet of the resource-based view that deals with how to obtain knowledge that is positioned as a strategic resource externally.

2.1.2 Knowledge-based View

The knowledge-based view of the firm is built upon the resource-based view of the firm by considering knowledge as the most crucial resource. In that regard, the knowledge-based view clearly differs from the resource-based view. Moreover, the knowledge-based view considers knowledge as the primary determinant of competitive advantage (cf. Kogut and Zander 1992, Spender and Grant 1996, Eisenhardt and Santos 2002, Caputo *et al.* 2019).

The understanding of knowledge is often made clear by relating it to data and information. Data is a fact or content that can be directly observed and verified. It is comprised of basic, unrefined, and generally unfiltered information. Information is

regarded as data that is given meanings. It contains meaning and is thereby useful. Knowledge, in turn, can be seen as information put in the context of human cognition, action, and experience. It involves the beliefs of humans and is intimately connected to action. Knowledge stems from information as information stems from data. Knowledge is more valuable than data and information as it is closer than them to human action (cf. Davenport and Prusak 1998, Dixon 2000, Bellinger *et al.* 2004, Liew 2007, van den Herik 2016, Dalkir 2017).

In companies, knowledge is often embedded in documents, rules, organizational routines, processes, practices, and also individuals (cf. Davenport and Prusak 1998, Tsoukas and Vladimirou 2001). Knowledge resides in humans, or human minds are described as tacit knowledge as a contrast to explicit knowledge. Explicit knowledge is often stored in a tangible form such as words, recordings, or pictures. In contrast, tacit knowledge is disembodied knowledge that is hard to be codified. Learning tacit knowledge is via an unstructured or semi-structured manner, such as experiencing and learning by doing.

The tacit nature of knowledge makes it difficult to be transferred and acquired (cf. Jeremy 1996, Cavusgil *et al.* 2003, Tsoukas 2005, Dalkir 2017). To make knowledge useful to others, the expression of knowledge must be interpretable (cf. Alavi and Leidner 2001, van den Herik 2016). Information is of little value unless it is processed through reflection, enlightenment, or learning. From the knowledge-based perspective, competitive firms are those that can better manage their knowledge (cf. Argote and Ingram 2000, Chuang 2004, Wang 2014). Especially, tacit knowledge has been argued to be in a central place in developing competitive advantages as it is difficult to substitute and transfer, and, on top of it, it is scarce (cf. Ambrosini and Bowman 2001, Pereira *et al.* 2012, Muthuveloo *et al.* 2017).

Davenport and Prusak (1998) suggest that the goals of KM in organizations should include: (1) making knowledge visible and show the role of knowledge in an organization, (2) developing a knowledge-intensive culture and purposely seeking and

sharing knowledge, (3) building a knowledge infrastructure to improve connections among people and encourage them to interact and collaborate for new knowledge. KM practices vary in different organizations and may include different processes (cf. Alavi and Leidner 2001, Rubenstein-Montano *et al.* 2001, Heisig 2009, Becerra-Fernandez and Sabherwal 2014). For instance, Alavi and Leidner (2001) consider KM as including four basic processes of knowledge creation, knowledge storage/retrieval, knowledge transfer, and knowledge application.

The knowledge-based view has strongly impacted the relevance of the concept of AC because AC is vital to developing, updating, and increasing a firm's knowledge base (cf. Cohen and Levinthal 1989, 1990). Hence, this study considers the knowledge-based view as a broader theoretic background against which the AC concept emerges.

2.1.3 Organizational Learning

Learning is "a purposive quest to retain and improve competitiveness, productivity, and innovativeness in uncertain technological and market circumstances" (Dodgson 1993, p. 378). Knowledge and organizational learning are major causes of organizational competitiveness and innovation (cf. Jiménez-Jiménez and Sanz-Valle 2011). The study of organizational learning centers on how organizations develop knowledge through the collective experiences of individuals in the organization in order to enhance organizational capabilities (cf. Fiol and Lyles 1985, Huber 1991, Slater and Narver 1995, Easterby‐Smith *et al.* 2000, Argote 2011).

Organizational learning research relates to AC in a few ways. Some fields of organizational learning overlap with AC research. For instance, organizational learning deals with learning at different levels of organizational communities. According to Tucker et al. (2007), organizational learning deals with learning at four levels: (1) individual, (2) group, (3) organization, and (4) inter-organization. Organizational learning involves various processes at different levels. For instance, Crossan *et al.* (1999) divide organizational learning into four processes: (1) intuiting, (2) interpreting, (3) integrating, and (4) institutionalizing. The intuiting and interpreting processes are

believed to occur mainly at the individual level. Integrating happens at the group level and institutionalizing at the organizational level.

Among the four levels, studies on inter-organizational learning are focused on how different organizations cooperate, share knowledge, and learn from one another (see Tucker *et al.* 2007). In comparison, AC studies focus on how organizations absorb external knowledge through recognition, assimilation, and utilization (see Cohen and Levinthal 1990). The external knowledge in AC studies is always created by other organizations and must cross organizational boundaries to be absorbed. Hence, AC studies can be viewed as coinciding with organizational learning at the inter-organizational level.

Furthermore, from the process perspective, Argote (2011, 2012) conceives organizational learning as including three sub-processes: (1) knowledge creation, (2) knowledge retention, and (3) knowledge transfer. The third sub-process, i.e., knowledge transfer, refers to knowledge sharing within and between organizations. Through knowledge transfer, an organization can learn and benefit from the knowledge spillovers from other organizations. So, studies of knowledge transfer in organizational learning overlap largely with AC studies as well. Here, the focus is on how an organization could improve its ability to quickly recognize, assimilate, and utilize external knowledge.

Therefore, we see organizational learning as representing a broader research area than AC. In this study, AC research is viewed as a branch of the organizational learning theory that focuses on knowledge transfer at the inter-organizational level (cf. Huber 1991, Beeby and Booth 2000, Argote 2011, Eiriz *et al.* 2017).

2.1.4 Dynamic Capabilities

Teece et al. (1997, p. 516) define dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments". Eisenhardt and Martin (2000) consider dynamic capabilities as a firm's routines that utilize resources to match and even produce market change, specifically the processes to obtain, integrate, recombine, and release resources. The

resource-based view of the firm emphasizes the role of valuable, rare, inimitable, and no-substitutable resources on sustainable competitive advantage (see Barney 1991). The theory of dynamic capabilities extends the resource-based view to the dynamic markets. It focuses more on the role of a firm's capacity to promptly reconfiguring internal resources and capabilities in a rapidly changing environment (see Teece *et al.* 1997). Amit and Schoemaker (1993, p. 35) state that capabilities "refer to a firm's capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end". From a routine-based perspective, dynamic capabilities are formed from various well-known processes such as alliancing, product development, and strategic decision making (cf. Eisenhardt and Martin 2000, Pavlou and El Sawy 2011, Teece 2018).

Some authors such as Vogel and Güttel (2013) labeled the core cluster of the literature of dynamic capabilities as "strategic learning and change" as it focuses on learning capabilities and relates them to company performance. They pay more attention to knowledge resources than their predecessors. This school of authors advocates that knowledge resources can be translated into human capital and firm capabilities through learning mechanisms at different levels. For instance, Zahra and George (2002, p. 185) treat AC as a "dynamic capability pertaining to knowledge creation and utilization". Hence, our study sees AC as one aspect of organizational dynamic capabilities.

2.1.5 Embedding AC in other Theories

Whatever the case, we consider the AC literature as being built upon a few related research streams. The resource-based view on companies is seen as a more fundamental theory underlying the knowledge-based view and theory of dynamic capabilities. Knowledge is a valuable resource. To obtain external knowledge is one aspect of managing all resource assets. Organizational learning is taken as arising from the knowledge-based view of firms. The study of AC overlaps with some sub-areas of organizational learning and dynamic capabilities. We view AC studies as overlapping with knowledge transfer studies of organizational learning at the inter-organizational level. AC is regarded by Zahra and George (2002) as one of the dynamic organizational

capabilities that deal mainly with how organizations accumulate and utilize knowledge from their environment (cf. Huber 1991, Zahra and George 2002, Argote 2011, Ince *et al.* 2016).

The underpinning of AC in this study is illustrated in Figure 2.1.

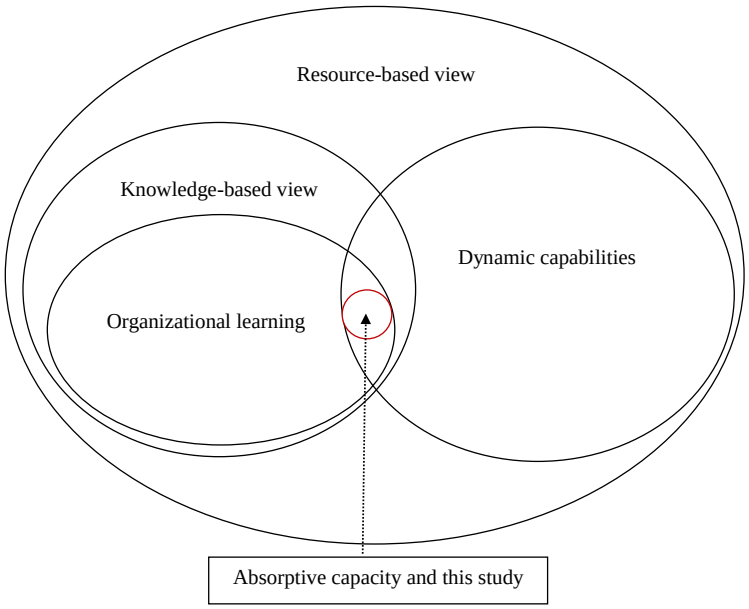

Figure 2.1: Theoretical Underpinnings of AC

2.2 AC Literature

AC has been a hot topic for three decades. Many works were devoted to reflecting, summarizing, and advancing the theoretical development of the concept. A few prominent examples are papers written by Cohen and Levinthal (1989, 1990), Zahra and George (2002), Lane *et al.* (2006), Todorova and Durisin (2007), Volberda *et al.* (2010), Lewin *et al.* (2011), Duchek (2013), Marabelli and Newell (2014), Senivongse *et al.* (2015), and Apriliyanti and Alon (2017). These studies not only build the theory of AC but also outline the main research streams of existing AC studies. Based on these work, the current section focuses on five aspects of existing AC studies: conceptualization of AC (Subsection 2.2.1), consequences of AC (Subsection 2.2.2), sources of AC (Subsection 2.2.3), measurement of AC (Subsection 2.2.4), and AC studies focused on SMEs (Subsection 2.2.5).

2.2.1 Conceptualization of AC

Cohen and Levinthal (1989, 1990) laid the theoretical fundament of the AC concept. They advocate that a firm's R&D is not only a direct source of new knowledge but also produces an ability which decides how much a firm can benefit from external knowledge spillovers. Knowledge spillover is defined in our study as follows (Definition 2.1).

Definition 2.1: Knowledge Spillover

> *Knowledge spillover* is the technical and organizational knowledge that is transferred among different agents such as another associate, competitor, supplier firm, or any other agent that they interact with. Both formal arrangements (e.g., licensing) and informal mechanisms (e.g., learning from social networks) can be involved (adapted from Dutrénit and Vera-Cruz 2003).

Cohen and Levinthal (1989, 1990) consider AC as a byproduct of in-house R&D. Both in-house R&D and acquisition of external knowledge contribute directly to a firm's accumulated knowledge base. In their conceptualization, in-house R&D is not only a direct source of a firm's knowledge base but also enables a firm to better benefit from external knowledge by enhancing its learning capabilities or AC. The exploitation of external knowledge is realized through the *interaction* of a firm's AC with external knowledge spillover. AC can be viewed as a *moderator* between the external knowledge spillovers and the ultimate benefit the firm can realize from the knowledge spillovers. With a strong AC, a firm may better recognize, assimilate, and utilize the external knowledge spillovers to improve its competitiveness. With a weak AC, a firm may not effectively absorb external knowledge for its benefits, even though there are many potential knowledge spillovers outside.

The interaction signifies that a firm cannot absorb externally available knowledge passively. To utilize the external knowledge effectively, the firm has to build its AC by investing in in-house R&D.

The relations between a firm's in-house R&D, AC, external knowledge spillover, and accumulated knowledge base are illustrated in Figure 2.2.

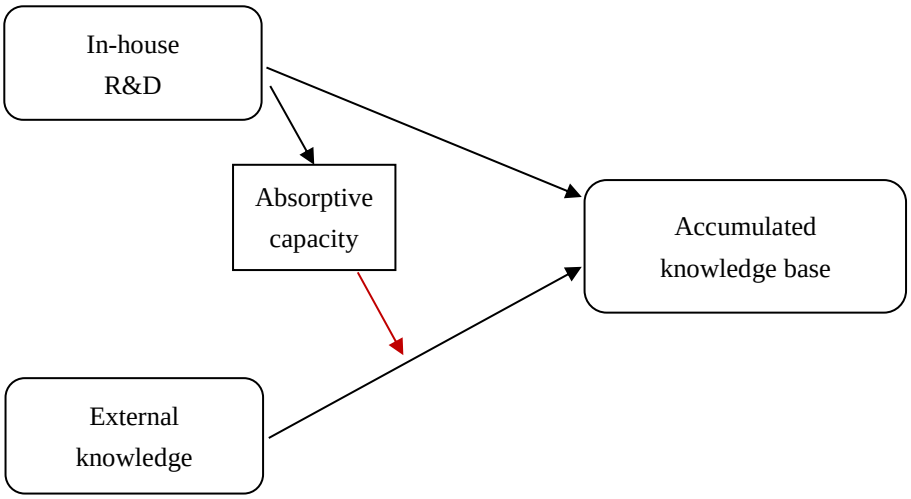

Figure 2.2: Relations between In-house R&D, AC, and External Knowledge

Source: Cohen and Levinthal (1990)

AC is of particular importance in adopting innovation in areas that require complementary internal efforts and pre-existing related knowledge (cf. Cohen and Levinthal 1989, 1990). Since Cohen and Levinthal's (1989, 1990) seminal work, many authors cited the concept and added their understanding to define them. Generally, most authors agree that AC is a series of capabilities needed to learn from others and obtain external knowledge. For instance, Mowery and Oxley (1995) treat AC as a set of organizational capabilities needed to handle the tacit aspects of inwardly transferred knowledge and the ability to apply a foreign-sourced innovation for domestic scenarios. Kim (1998) sees AC as organizational capabilities to assimilate external knowledge for imitation and problem-solving skills to generate new knowledge for innovation.

Lane and Lubatkin (1998) invented the term "relative AC" to describe the phenomenon that a firm's AC is relative, and firms have various levels of AC when absorbing knowledge from different external organizations. They argue that a firm's capacity to learn from other organizations depends on the similarity between them. The more similarity the student and teacher firms have, the easier the student firm can recognize, assimilate, and utilize knowledge originating from the teacher firm. Except for the similarity in prior knowledge bases, they suggest that similarity in organizational structures, compensation policies, and dominant logics also contribute to enhancing a

firm's AC. The relationship between the performance of inter-organizational learning and the degree of similarity may not be linear. Too much similarity may reduce the potential of inter-organizational learning, as there is not much to learn from each other.

Thus, the challenge is to decide an optimal level of similarity so that there is sufficient dissimilarity to learn something new, but not so different as to preclude mutual understanding and productive knowledge exchange (see Nooteboom *et al.* 2007). Their point of view adds to Cohen and Levinthal's suggestion that diversity help individuals think innovatively and make novel linkages by stressing that a certain degree of similarity between different organizations can increase efficiency in communication and inter-organizational learning.

In Cohen and Levinthal's (1989, 1990) original conceptualization, AC is divided into three processes: (1) external knowledge recognition (EKR) (see Definition 1.7), (2) external knowledge assimilation (EKA) (see Definition 1.8), and (3) external knowledge utilization (EKU) (see Definition 1.9). Some other authors extend the concept by treating AC as a four-dimension concept, including (1) external knowledge acquisition by (a) identifying and (b) acquiring the new knowledge, (2) external knowledge assimilation based on current knowledge base, (3) transformation of the knowledge by expanding the firm's existing knowledge base, and (4) exploitation of this knowledge by delivering high-value knowledge and products and services (see Zahra and George 2002).

Both the three-dimensional conceptualization and the four-dimensional conceptualization cover the complete knowledge absorbing process. However, Cohen and Levinthal (1989, 1990) phrased the first process of AC as knowledge recognition through identifying or evaluating the potential external knowledge. Zahra and George (2002) expressed the first step as knowledge acquisition by (a) identifying external knowledge and (b) then acquiring it. Hence, the knowledge identification activity is similar to the knowledge recognition process in Cohen and Levinthal's (1989, 1990) conceptualization. Though Cohen and Levinthal (1989, 1990) do not phrase knowledge acquisition and transformation as individual processes, the knowledge assimilation process in their definition can be regarded as relating to the acquiring activity,

knowledge assimilation, and knowledge transformation process contained in the conceptualization by Zahra and George (2002). The knowledge acquiring activity in the knowledge acquisition process and the knowledge transformation process of the conceptualization by Zahra and George (2002) can be incorporated in the knowledge assimilation process because knowledge assimilation can only occur after the intended knowledge is acquired, and the necessary transformation is completed (see Todorova and Durisin 2007). Hence, the knowledge assimilation process in Cohen and Levinthal's (1989, 1990) definition can be regarded as corresponding to the knowledge acquiring activity, the knowledge assimilation process, and the knowledge transformation process in the definition of Zahra and George (2002). The knowledge utilization process in Cohen and Levinthal's (1989, 1990) conceptualization coincides with the knowledge exploitation process in Zahra and George's (2002) conceptualization in a way that both emphasize realizing the value of the external knowledge assimilated.

Zahra and George (2002) further define the first two dimensions in their definition as the potential AC and the latter two dimensions as the realized AC. Potential AC represents a firm's receptivity to acquiring and assimilating new knowledge. Realized AC is a firm's ability to transform and exploit acquired knowledge, which represents a firm's capacity to leverage and profit from the absorbed knowledge (see Zahra and George 2002). Zahra and George further argue that potential AC and realized AC could be distributed unevenly within the same firm as "…firms can acquire and assimilate knowledge but might not have the capability to transform and exploit the knowledge for profit generation" (Zahra and George 2002, p. 191).

In their conceptualization, Lewin *et al.* (2011) decompose the construct of AC into two components: internal AC and external AC. Internal AC is a firm's ability to manage the processes of internal variation, selection, and replication of new knowledge and best practices. External AC is defined as the exploration of new knowledge in the external environment and the assimilation process.

More recently, Song *et al.* (2018) identified three dimensions of AC, including (1) absorptive knowledge base, (2) absorptive effort, and (3) absorptive process. The absorptive knowledge base is the existing knowledge stock of a company. Absorptive effort refers to the investments committed by a firm for building up knowledge. The absorptive process includes a firm's internal procedures and practices connected to knowledge diffusion.

Different conceptualizations of AC may have consequences in determining how it is operationalized, particularly when we decide what and how many processes AC may contain. It also influences how AC is measured in quantitative studies, as many non-R&D measurements gauge AC by directly measuring each of its dimensions or processes (see Subsection 2.2.4).

Table 2.1 shows the five most cited AC conceptualizations identified by this study.

2.2.2 Consequences of AC

Cohen and Levinthal (1990) suggest that AC influences expectation formation and the aspiration level of the firm. It allows the firm to foresee more accurately the nature and commercial value of new technology. Hence, a higher level of AC will lead to a firm's proactiveness in exploiting new external opportunities (cf. Cohen and Levinthal 1990). Scholars have since cited AC to explain variances between firms in competitive advantages and organizational performance. Most existing studies have supported that AC has a significant positive effect on firm performance (e.g., Song *et al.* 2018).

Table 2.1: Important AC Conceptualizations

Key conceptualization	Contributions to the conceptualization of AC	Source
Three-dimensional conceptualization: AC is a set of organizational capabilities to (1) recognize, (2) assimilate, and (3) utilize external knowledge.	Laying the groundwork by conceptualizing AC and highlighting the role of it in accumulating knowledge and innovation	Cohen and Levinthal (1990)
Relative AC: A firm's AC is relative, and firms have various levels of AC when absorbing knowledge from different external organizations.	AC is not solely determined by internal factors but also by relations with external sources, such as the similarity between the two	Lane and Lubatkin (1998)
AC is divided into (A) potential AC and (B) realized AC. Potential AC represents a firm's receptivity to (1) acquiring, and (2) assimilating new knowledge. Realized AC is a firm's ability to (3) transform, and (4) exploit acquired knowledge, which represents a firm's capacity to leverage and profit from the absorbed knowledge.	Extending the AC concept to four dimensions, and further highlighting that potential AC and realized AC are two different aspects of AC, and they can be distributed unevenly within the same firm	Zahra and George (2002)
AC is divided into (1) Internal AC as internal variation, selection, and replication of new knowledge and best practices, and (2) external AC as the exploration for new knowledge in the external environment and the assimilation process.	Underlying that both internal and external processes are essential in absorbing external knowledge	Lewin *et al.* (2011)
Three dimensions are divided: (1) absorptive knowledge base, (2) absorptive effort, and (3) absorptive process.	Identifying three groups of sources of AC, and incorporating the sources into its conceptualization	Song *et al.* (2018)

According to Zahra and George (2002), firms with a higher potential AC, higher capabilities of knowledge acquisition and assimilation, are more capable of updating their knowledge base and other capabilities needed for competing in a changing environment. AC directly enhances organizational performance indirectly through mediators. For instance, Zahra and George (2002) suggest that a well-developed realized AC can achieve a competitive advantage through more successful innovation and product development. Chang *et al.* (2013) find that realized AC and potential AC are positively associated with market responsiveness and firm innovativeness, which are important aspects of firm performance. Through a meta-analysis of 241 studies, Zou *et*

al. (2018) find that the effect of AC effects on firms' financial performance is fully mediated innovation and knowledge transfer.

However, firms may also be worse off to have too much AC. According to Cohen and Levinthal (1989), an existing knowledge base in combination with an AC may have both positive and negative influences on knowledge absorption processes in companies. On the one hand, existing knowledge defines the locus of knowledge search. It makes the knowledge absorbing process more effective when the intended knowledge is connected to the existing knowledge base. On the other hand, prior experience and knowledge may limit a firm's search scope only to areas that are proximate and familiar to the existing knowledge. Hence, AC has a path-dependent or accumulative nature in its conceptualization.

Some authors caution that firms need to have a balance between their potential AC and realized AC. They argue that, if too many resources were concentrated on acquiring and assimilating external knowledge, firms might suffer from high costs incurred in the acquisition and assimilation processes without being able to exploit the potential value of the acquired knowledge (e.g., Zahra and George 2002, Lichtenthaler 2009).

Hence, the relationship between AC and organizational performance is more likely to be curvilinear instead of linear. Based on data from 285 technology-based small and medium enterprises, Wales *et al.* (2013) suggest an inverted-U shaped relationship between AC and financial firm performance. When the measures exceed the optimal level, AC even has a negative effect on performance and becomes harmful to firms.

The review above shows that the current way of measuring the impact that AC may have on the firms is still not conclusive. More studies are needed to uncover (1) the mechanisms through which AC may have an impact and (2) the specific conditions surrounding the measuring procedure.

2.2.3 Sources of AC

This subsection deals with sources of AC. We distinguish two distinct lines: (A) organizational factors that influence of AC, and (B) environmental factors that influence AC.

A: Organizational Factors that Influence AC

To fully exploit the AC concept and explore future fruitful extensions of the concept, we need to understand what organizational factors may help build up AC (cf. Volberda *et al.* 2010). Drawing from the cognitive basis for an individual's learning ability, Cohen and Levinthal (1990) see prior knowledge and diverse expertise as the most direct sources of organizational AC. Hence, measures that contribute to knowledge creation and accumulation in certain areas, such as R&D investment, manufacturing activities, and external collaboration, can help enhance a firm's AC. Among these measures, R&D investment is considered the most important source of AC. Some researchers advocate that AC research should be extended to non-R&D contexts in order to capture the complexity of its various dimensions because AC is not a static resource but a process or ability (e.g., Lane *et al.* 2006).

Some authors have emphasized four organizational factors that are essential to enhance the AC of a firm: (1) prior relevant knowledge, (2) effective communication network, (3) appropriate communication climate, and (4) effective knowledge scanning (e.g., Tu *et al.* 2006, Ali *et al.* 2013). Employee ability and motivation are also principal sources of the firm's AC (e.g., Martinkenaite and Breunig 2016, Elbaz *et al.* 2018). That is consistent with Cohen and Levinthal's (1990) argument that AC resides in individual employees who work in the firm. Particularly, a firm's AC depends on the key individuals who are responsible for interacting with external knowledge sources and communicating between different subunits in the firm. Knowledge workers' cognitive process of perspective-taking and their creative behavior are important micro-foundations of AC (cf. Volberda *et al.* 2010, Distel 2019).

The study by Duchek (2015) showed that a firm's AC not only depends on the basic organizational form but also on complementary structures. R&D centrality, gatekeeper

positions, and interface positions matter when transferring knowledge across different organizations and business units. For instance, a centralized R&D unit can broaden the search scope and enhance the efficiency of the knowledge absorption process. Gatekeeper positions help acquire external knowledge and disseminate internal knowledge across the organization, and interface positions facilitate better integration and application of the acquired knowledge.

AC was first seen as one of a firm's capabilities. Grant (1991) argues that capability is essentially a routine or some interacting routines. Organizational Routines (Definition 2.2) in this study are defined as follows.

Definition 2.2: Organizational Routines

Organizational routines are defined in this study as distinct behavioral patterns that involve both formal and informal processes and sophisticated social practices in organizations (Adapted from Dosi *et al.* 2001, Nicolini *et al.* 2003).

Seeing AC as comprising various routines, Vinding (2004) stresses that HRM practices such as formal education, work experience, the organizational set-up, and a closer relationship between different actors, all contribute to enhancing a firm's AC. In a more recent study, Zhou *et al.* (2020) find that different dimensions of AC can be developed by specific HRM practices. For example, better internal communication can facilitate knowledge acquisition capability. Internal training has a positive impact on knowledge assimilation capability, and greater use of performance appraisal systems can positively influence the knowledge exploitation capabilities of the companies.

Some authors have investigated the role of some other specific organizational practices on absorbing external knowledge. Such organizational practices include the participation of academic and industrial conferences (e.g., Spencer 2003), technological alliances with external partners (e.g., Anand *et al.* 2010, Love *et al.* 2016), collaboration with universities and research institutes (e.g., Bishop *et al.* 2011, Rajalo and Vadi 2017), utilization of online database and open-source resources (e.g., Vujovic and Parm Ulhøi

2008, Hossain *et al.* 2018), provider and user involvement (e.g., Möller *et al.* 2008, McQueen 2019). The knowledge-building investments made by a firm, the current knowledge stock of a firm, and a firm's internal procedures and practices related to knowledge diffusion are also seen as primary sources of organizational AC by Song *et al.* (2018).

Table 2.2 lists some of the essential organizational factors of AC identified by this study.

Table 2.2: Organizational Factors that Influence AC

Important Factors that Influence AC	Examples of Related Authors
Prior knowledge and diverse expertise: R&D investment, manufacturing activities, and external collaboration	e.g., Cohen & Levinthal (1989; 1990)
Diverse and complementary sources of external knowledge and experience	e.g., Zahra and George (2002)
Prior relevant knowledge, communications network, communications climate, and knowledge scanning mechanisms.	e.g., Tu *et al.* (2006); Ali *et al.* (2013)
Employees' ability and motivation	e.g., Martinkenaite and Breunig (2016); Elbaz *et al.* (2018)
Knowledge-building investments made by a firm, current knowledge stock of a firm, and a firm's internal procedures and practices related to knowledge diffusion	e.g., Song *et al.* (2018)
HRM practices, such as formal education, work experience, the organizational set-up, a closer relationship between different actors, internal communication and training, and performance appraisal systems	e.g., Lund Vinding (2004); Zhou *et al.* (2020)

B: Environmental Factors that Influence AC

Some scholars have emphasized environmental factors that affect knowledge-absorbing processes and the outcomes in organizations (see Table 2.3). One frequently mentioned environmental factor by many authors is the *regime of appropriability* (e.g., Cohen and Levinthal 1990, Zahra and George 2002, Volberda *et al.* 2010, Crowley and Jordan 2018). The regime of appropriability refers to the institutional and industry

dynamics that affect a firm's ability to take advantage of new technology and innovation (cf. Hurmelinna *et al.* 2007, Hurmelinna‐Laukkanen *et al.* 2008).

Table 2.3: Environmental Factors of AC

Environmental factors that affect AC	Authors
The regime of appropriability	e.g., Cohen and Levinthal (1989, 1990)
The regime of appropriability, activation triggers, social integration mechanisms	e.g., Zahra and George (2002)
Power relations	e.g., Todorova and Durisin (2007)
The intensity of competitiveness, dynamism, knowledge characteristics, and the regime of appropriability	e.g., Volberda *et al.* (2010); Wang *et al.* (2015)
Knowledge type ("what"), governance mode used for approaching external knowledge ("how"), and source of external knowledge ("from whom")	e.g., Song *et al.* (2018)
Organizational culture	e.g., Zerwas (2014); Limaj and Bernroider (2019)

Traditionally, it was believed that a firm's incentive to invest in internal R&D decreases under weak regimes as it is hard for companies to appropriate the outcomes of their R&D investment. The investment might be uneconomic because competitors can easily copy or imitate the outcomes (cf. Boisot and Griffiths 1999, Crowley and Jordan 2018). When the appropriability is low, it is easy to copy from other companies. That may increase the opportunity to absorb their knowledge. In such cases, plenty of external spillovers may encourage internal R&D investment because firms need to build a high level of AC through R&D investment in order to better benefit from external knowledge. According to Cohen and Levinthal (1990), the positive absorption incentive associated with spillovers may be strong enough in some cases to offset the negative appropriability incentive.

Except for the regime of appropriability, factors such as activation triggers and social integration mechanisms may also moderate a firm's ability to translate external knowledge into its competitive advantages (see Zahra and George 2002). Todorova and Durisin (2007) see power relations, and Volberda *et al.* (2010) consider the intensity of competitiveness, dynamism, and knowledge characteristics as environmental factors

that may affect an organizational AC. Song *et al.* (2018) discern knowledge type ("what"), ways of governance for approaching external knowledge ("how"), and source of external knowledge ("from whom") as three important contingency factors that influence outcomes of absorbing external knowledge. A more open and balanced organizational culture can also affect a firm's ability to benefit from new knowledge absorbed from external sources (cf. Harrington and Guimaraes 2005, Zerwas 2014, Limaj and Bernroider 2019).

The existence of various factors that can affect AC, particularly the environmental factors, indicates that it is not an easy task to build up AC and to determine how AC may affect the organizations. It is decided by the specific characteristics of the organization and the circumstances surrounding it. Hence, it is beneficial in the future AC studies to specify the circumstances surrounding them and extend the investigations to different scenarios.

2.2.4 Measurement of AC

In order to better understand how AC interacts with other factors such as organizational performance, many empirical studies focused on AC emerge, and a variety of measures of AC have been developed. In general, there are two primary ways of measuring AC in existing studies: (A) R&D-related measures and (B) Non-R&D measures.

A: R&D-related measures

The majority of empirical studies on AC uses R&D-related indicators to measure the construct rather than measure it directly. Both input and output related indicators are used as proxies for AC. Frequently used R&D-related input indicators for AC include R&D intensity measured by R&D spending as a percentage of company sales (e.g., Cohen and Levinthal 1990, Stock *et al.* 2001), or the size of R&D personnel (e.g., Gao *et al.* 2008, Huang *et al.* 2015c). Output-oriented indicators of AC include the number of patents and patent citations (e.g., Mowery *et al.* 1996, George *et al.* 2001), or the number of R&D publications and their cross-citation rate (e.g., Deeds 2001). Some

authors measure AC by combining different output indicators such as R&D intensity and the number of patent citations (e.g., Kostopoulos *et al.* 2011, Aldieri *et al.* 2018).

However, some scholars have expressed concerns and critics on the use of R&D-related proxies to measure AC. A few even provide empirical evidence about the relatively low explanatory power of R&D spending in comparison to the explanatory power of multiple dimensions of AC (e.g., Lane and Lubatkin 1998, Lichtenthaler 2009). Organizational AC consists of various organizational practices that are beyond R&D-related activities.

Though Cohen and Levinthal (1989, 1990) initially consider the AC as a byproduct of in-house R&D, the role of non-R&D activities, such as manufacturing and HRM, in building up firm AC are also recognized. Duchek (2013) argues that using only R&D-related proxies to measure AC fails to capture the multidimensional and structural nature of AC. Most of these R&D-related measures are particularly inadequate for SMEs. Because SMEs do not always have a specific R&D department, and many SMEs consider the patent process to be too expensive and time-consuming. Furthermore, the absence of an R&D department or a patent registration policy in most SMEs does not represent that they do not absorb external knowledge (cf. Hervas-Oliver *et al.* 2012, Chauvet 2014).

B: Non-R&D measures

Many other studies have used non-R&D proxies for AC. These non-R&D measures often correspond to different AC conceptualizations. The focus is on accurately identifying the processes firms adopt in absorbing external knowledge, linking them to separate components or dimensions of AC, and then adequately measuring them by using surveys or questionnaires (cf. Cadiz *et al.* 2009, Jiménez-Barrionuevo *et al.* 2011, Harris and Yan 2019).

Some researchers treat AC as a one-dimensional concept and have developed single questions or a set of questions to measure the overall AC. For example, Szulanski (1996) and Su *et al.* (2013) treated AC as a one-dimensional construct. They measured it with

designed items to capture the overall ability of firms to identify, assimilate, and apply external knowledge.

Due to the multi-dimensional nature of AC, it is believed that a single one-dimensional measure is not appropriate to measure AC. In a study focused on the relationship between HRM practices, AC, and knowledge transfer in multinational corporations, Minbaeva *et al.* (2003) conceptualize AC as comprising employees' ability and motivation. They develop three items to indicate ability and five items to indicate motivation as a measurement of AC. Some recognize the multi-dimensional nature of AC and developed measures for the three processes of knowledge recognition, assimilation, and utilization (e.g., Lane *et al.* 2001, Cadiz *et al.* 2009, Zobel 2017). Nieto and Quevedo (2005) use four groups of non-R&D factors as the proxy indicators in their questionnaire to measure a firm's AC, including (1) external communication, (2) intensity of internal know-how and experience, (3) knowledge breadth and overlaps in the knowledge structure, and (4) strategic positioning.

Tu *et al.* (2006) and Ali *et al.* (2013) consider AC as a second-order construct comprised of four first-order sub-constructs: (1) prior relevant knowledge, (2) communication network, (3) communication climate, and (4) knowledge scanning. They measure AC by developing items to measure each of the four sub-constructs. Some others treat AC as a four-dimensional concept that includes acquisition, assimilation, transformation, and exploitation and develop scales of them to measure AC quantitively (e.g., Jansen *et al.* 2005, Chauvet 2014). Jiménez-Barrionuevo *et al.* (2011) and Flatten *et al.* (2011a) differentiate between acquisition, assimilation, transformation, and exploitation and develop a measurement for each of the dimensions with questionnaires.

The significant difference between the one-dimensional measurement and multidimensional measurement is that the latter allows researchers to single out a specific individual dimension for analysis as different components of AC are measured and distinguished. Though the one-dimensional measure of AC may adopt multiple items or indicators, the measures are down to a scale of the concept as a whole. Duchek

(2013) argues that these non-R&D measures can provide more useful information about the degree of AC than the R&D-related indicators, as the former identifies the process of knowledge absorption.

Table 2.4 shows an overview of different measurement methods over AC.

Table 2.4: Different Measurement of AC

Categories of measurement		Authors
R&D-related measures	Input indicators	e.g., Cohen and Levinthal (1990); Stock *et al.* (2001); Gao *et al.* (2008); Huang *et al.* (2015c)
	Output indicators	e.g., Mowery *et al.* (1996); George *et al.* (2001); Deeds (2001)
	Integrating both input and output indicators	e.g., Kostopoulos *et al.* (2011); Aldieri *et al.* (2018)
Non-R&D measures	One-dimensional measures	e.g., Szulanski (1996); Su *et al.* (2013)
	Multi-dimensional measures	e.g., Minbaeva *et al.* (2003); Nieto and Quevedo (2005); Ali *et al.* (2013); Zobel (2017)

Based on the previous discussion, we may conclude that multidimensional non-R&D measures seem to be better indicators of AC in quantitative studies.

2.2.5 AC Studies on SMEs

Smaller companies typically suffer from scarce resources comparing to big firms (cf. Carson *et al.* 1995, Gruber 2003). Except for the lack of tangible resources, SMEs tend to lack specific competencies and knowledge comparing to big firms. Freel (1999) identified technical skills in the workforce, managerial competency, and poor marketing skills as primary skills that small firms may lack compared to more prominent companies. Gray (2006) suggests that the knowledge base in smaller companies, micro-firms in particular, is weak compared with larger firms.

Many authors have applied the concept of AC to examine how SMEs collaborate with external sources for new knowledge and innovation and the impact of absorptive on SMEs. For instance, Liao *et al.* (2003) examined the relationship between different dimensions of AC and organizational responsiveness in the context of 284 growth-oriented SMEs. Organizational responsiveness refers to the action organizations take in

response to the new information acquired and disseminated. It is related to organizational performance and reflects how fast and how well coordination with which actions are implemented and periodically reviewed. The study operationalizes AC into two dimensions: external knowledge acquisition and intra-firm knowledge dissemination. They designed measures of each dimension and organizational responsiveness. The results of the quantitative study indicate that both dimensions of the AC of SMEs have positive effects on their organizational responsiveness.

In a study testing potential mediating effect of strategic alliances between AC and the performance of SMEs, Flatten *et al.* (2011b) suggest that AC has a positive effect on SME performance. Strategic alliances partially mediate the relationship between AC and firm performance. In other words, AC impacts organizational performance, both directly and indirectly. The indirect impact of AC on firm performance is exerted through influencing strategic alliances, and strategic alliances, in turn, have a positive impact on the performance of SMEs.

From a practice-based perspective, Duchek (2015) investigated what organizational structure may determine the AC of SMEs with a qualitative approach. With case studies of two innovative medium-sized firms in the German engineering industry, the study suggests that division form, the centrality of R&D, gatekeeper positions, and interface positions are essential determinants of AC.

More recently, Aboelmaged and Hashem (2019) examined the relationships between AC, sustainable capabilities, and green innovation adoption in the SME context. The result of the study shows that AC positively influences sustainable capabilities and green technology adoption in SMEs. Further, the findings indicate that sustainable orientation and collaboration capabilities mediate the effect of AC on green innovation adoption.

Most of the existing AC studies, particularly quantitative ones, cite the concept of AC without providing its definition. AC is treated in the studies like a black box without clarification of what operational processes it may contain. Therefore, some researchers have called for more empirical studies focusing on the inherent processes of knowledge

absorption (e.g., Lewin *et al.* 2011, Marabelli and Newell 2014, Duchek 2015). Consequently, the outcomes of current studies lack valid operational suggestions that can direct management practices in SMEs.

Whatever the case, the majority of the theory development of AC has been based on big firms. It is evidenced by many authors treating AC as a byproduct of R&D activities and uses R&D-related indicators to represent AC (cf. Cohen and Levinthal 1990, George *et al.* 2001, Aldieri *et al.* 2018). However, most SMEs are in non-technology industries. Moreover, even in technology-based industries, SMEs tend to be lacking the resources to invest heavily in R&D (cf. Narula 2004, Väyrynen *et al.* 2017). Thus, the current conclusions reached from AC studies on big firms may not apply to SMEs. Therefore, separating SMEs from large firms in studies on AC processes is necessary and deserves more special attention.

2.3 Chapter Conclusion

In this chapter, we reviewed literature related to the concept of AC and specified relations between AC and four theories. By doing so, we positioned AC and our study in a broad and sound theoretic base. The four theories investigated include the resource-based view, the knowledge-based view, organizational learning, and dynamic capabilities. They are reviewed in relation to each other. Then, this chapter took a close look at the existing studies that are focused on AC. Several vital topics discussed in previous AC studies, including its conceptualization, sources of AC, measurement of AC, and AC studies and SMEs, are highlighted and discussed in the chapter.

Based on our analysis, we may conclude that we need to (1) improve our understanding of the knowledge-absorbing processes in SMEs and (2) formulate more operational suggestions on how SMEs should absorb external knowledge. Our study will adopt both qualitative and quantitative methods to investigate (1) how SMEs absorb external knowledge, (2) what challenges they face in the AC processes, and (3) whether different knowledge assimilation mechanisms have an impact on firm performance.

In the next chapter, we use in-depth interviews to investigate specific processes of SMEs to absorb external knowledge. With the interviews, we attempt to address the issues of how SMEs absorb external knowledge from a process view.