Abstract

Openness in innovation and reliance on external knowledge sources are widely acknowledged to be crucial for a firm’s innovation success and competitiveness (Chesbrough, 2003; Dahlander and Gann, 2010; West and Bogers, 2017). To capture value from such openness and be able to benefit from external knowledge impulses, firms require absorptive capacity (hereafter AC) (Cohen and Levinthal, 1990; Zahra and George, 2002). There have been numerous studies of the concept of AC in large, R&D-intensive firms operating in high-tech industries. In contrast, much less is known about AC in manufacturing firms without formal R&D. Interest in the AC of non-R&D-performing firms is motivated by two contradictory aspects. On the one hand, reliance on external innovation sources may help non-R&D-performing firms to complement limited internal resources (e.g. Santamaria et al., 2009). On the other hand, in order to access and exploit external knowledge sources successfully, these firms need sufficient internal resources and competences. Consequently, despite the extensive academic attention devoted to AC, there are no deeper insights to date into how non-R&D firms manage the absorption of external knowledge, and which internal resources and organisational practices enable such absorption. Hence, this study aims to explore the construct beyond the R&D-based context. Based on qualitative data, it shows how non-R&D firms deploy their AC, and how individuals and organisational practices are interrelated in the process of knowledge absorption.

This study argues that, despite the lack of formal R&D efforts, non-R&D firms can still possess the necessary AC oriented towards technological knowledge. There are at least two reasons for this argument. First, the selection of relevant knowledge sources and the search strategy are strongly driven by the firm’s strategy (Lane et al., 2006). Empirical studies showed that non-R&D firms do successfully access and use technological, scientific knowledge if this knowledge is of high strategic relevance to them (e.g. Bender, 2008). Second, not all activities within an absorption process require R&D efforts (Boegers and Lhuillery, 2011). Given the marked differences in the structural characteristics, innovation resources and innovation behaviour between non-R&D and R&D firms (e.g. Som, 2012), it is to be expected that non-R&D firms absorb knowledge in a different way to R&D firms. In order to unpack the concept of absorptive capacity in the less studied non-R&D context, a multi-level
This study applies a qualitative, explorative perspective using a qualitative multiple case study design (Yin, 2006). Four cases have been identified using theoretical sampling targeting innovative German manufacturing firms with no formal in-house R&D. The primary data were collected in semi-structured qualitative interviews (Miles and Gilbert, 2005) and complemented by additional sources of evidence to assure the construct validity (Yin, 2006). Qualitative content analysis following the ?Gioia Methodology' was used to analyse the data (Gioia et al., 2013).

The results reveal that non-R&D firms pursue an individual-centred way of absorbing external knowledge. Their AC is based on a few key individuals and broadly anchored in different departments. To succeed with only a few key knowledge workers, the analysed firms rely strongly on diverse organisational practices to effectively integrate individual capabilities into a collective outcome. Thus, in non-R&D firms, the interplay between individual capabilities and organisational mechanisms seems to enable and foster the absorption of technological knowledge.

This study contributes to the AC research by responding to a call to explore absorptive capacity beyond the R&D context (Lane et al., 2006). It highlights aspects of AC that are not noticeable in the studies dominated by a R&D focus. Second, it adds to the multi-level research on AC by enhancing our understanding of the interplay between individual-level and organisational-level aspects (e.g. Felin et al., 2012). In addition, this study responds to the methodological critique and uses qualitative research methods to open up new perspectives on studying AC and to extend the ideas based largely on quantitative research.

References
Exploring absorptive capacity in non-R&D innovative firms: The interplay between individuals and organisational practices

Nadia Weidner a*

aChair of Innovation Management, Institute of Management, Freie Universität Berlin, Germany; Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe, Germany

Breslauer Straße 48, 76139 Karlsruhe, Germany
E-mail: nadia.weidner@isi.fraunhofer.de
*corresponding author
Exploring absorptive capacity in non-R&D innovative firms: The interplay between individuals and organisational practices

Abstract: How do manufacturing firms without formal R&D manage the absorption of external technological knowledge? Despite the extensive academic attention devoted to absorptive capacity, there is still a limited understanding of the concept beyond the R&D context. It is often assumed that non-R&D firms are not well equipped to benefit from external impulses. To question this assumption, this study explores how non-R&D firms deploy their absorptive capacity, and reveals how individuals and organisational practices are interrelated in the process of knowledge absorption. Based on qualitative data from case studies with four non-R&D-performing German manufacturing firms, the results reveal that these firms pursue an individual-centred absorption of external knowledge by relying on a few key individuals from different departments. To effectively integrate individual capabilities into a collective outcome, the analysed firms deploy diverse organisational practices. Thus, the interplay between individuals and organisational mechanisms seems to enable and foster knowledge absorption in the non-R&D context.

Keywords: absorptive capacity; non-R&D firms; multi-level perspective; external knowledge sources; case studies


1 Introduction

Openness in innovation and reliance on external knowledge sources are widely acknowledged to be crucial for a firm’s innovation success and competitiveness (Chesbrough, 2003; Dahlander and Gann, 2010; West and Bogers, 2017). To capture value from such openness and be able to benefit from external knowledge impulses, firms require absorptive capacity (hereafter AC) (Cohen and Levinthal, 1990; Zahra and George, 2002). The concept of AC is well established for large, R&D-intensive firms operating in high-tech industries and the majority of empirical findings in AC research stem from the analysis of such firms (e.g. Lane and Lubatkin, 1998; Lenox and King, 2004; Patterson and Ambrosini, 2015). In contrast, much less is known about AC in manufacturing firms without formal R&D, even though about half of all European firms innovate without performing R&D (Arundel et al., 2008).

Interest in the AC of non-R&D-performing firms is motivated by two contradictory aspects. On the one hand, reliance on external innovation sources may help non-R&D-performing firms to complement limited internal resources (e.g. Santamaria et al., 2009). On the other hand, in order to access and exploit external knowledge sources successfully, these firms need sufficient internal resources and competences. As non-R&D innovators are predominantly SMEs (Arundel et al., 2008; 2015), they are usually limited in terms of the financial resources and qualified personnel (Hirsch-Kreinsen, 2015; Lee et al., 2010; Rammer et al., 2009; Van de Vrande et al., 2009).

Previous empirical studies showed that, despite their lack of formal R&D, non-R&D firms successfully access and use technological, scientific knowledge if this knowledge is of high strategic relevance to them (e.g. Bender, 2008) and therefore do have sufficient AC. However, to date, deeper insights are still missing into how non-R&D firms manage the absorption of external knowledge and which internal resources and organisational practices enable such absorption. Hence, this study aims to explore the construct of AC beyond the R&D-based context. By applying a qualitative explorative approach, it shows how non-R&D firms deploy AC, and how individuals and organisational practices interrelate in the process of knowledge absorption.

This study contributes to AC research by responding to a call to explore AC beyond the R&D-based context (Lane et al., 2006). Given the marked differences in structural characteristics, innovation resources and innovation behaviour between non-R&D and R&D firms (e.g. Som, 2012), it is to be expected that non-R&D firms absorb
knowledge in a different way to R&D firms. Therefore, this study identifies and highlights aspects of AC that are not noticeable in the studies dominated by a R&D focus, but that are useful for advancing the theoretical development of the concept.

Furthermore, this study advocates the need for a better understanding of the multi-level nature of AC (Volberda et al., 2010). In order to unpack the concept of AC in the less studied non-R&D context, it applies a multi-level perspective (e.g. Felin et al., 2012). The results underline the importance of the interplay and fit between individual capabilities and organisational mechanisms for enabling and fostering the absorption of technological knowledge in non-R&D firms.

In addition, this study responds to the methodological critique (Flatten et al., 2011; Murovec and Prodan, 2009) and uses qualitative research methods to open up new perspectives on studying AC and to extend the ideas based largely on quantitative research.

The paper is organised as follows. The next section provides the theoretical background on AC and describes the specific characteristics of non-R&D firms. The third section explains the research design of the qualitative study and introduces the cases selected for analysis. This is followed by a description and a discussion of the main cross-case findings. The final section closes by summarising the contributions of the study.

2 Theoretical background

This section summarises the existing literature on AC and familiarises the reader with the non-R&D-based context by describing distinctive characteristics of non-R&D-performing firms.

Existing theory on absorptive capacity

The concept of AC was introduced by Cohen and Levinthal (1989; 1990) and defined as “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends” (1990, p. 128). After its introduction in 1989 by Cohen and Levinthal, the concept of absorptive capacity has been enhanced in a number of reconceptualisations (e.g. Lane et al., 2006; Lewin et al., 2011; Todorova and Durisin, 2007; Van Den Bosch, Frans A.J. et al., 1999; Volberda et al., 2010; Zahra and George, 2002). One of the latest definitions of AC was introduced by Zahra and George (2002). They extend the original concept (Cohen and Levinthal, 1989; Cohen and Levinthal, 1990).
1990) by concentrating on internal processes and defining AC as a dynamic capability embedded in a firm’s routines. They were the first to split AC into potential and realised dimensions. The potential dimension reflects a firm’s ability to acquire and assimilate external knowledge, whereas the realised dimension embraces a firm’s ability to transform and exploit this knowledge.

Subsequent research has largely adopted the core underlying assumptions proposed in the seminal work of Cohen and Levinthal (1990). First, the research adopted the strong R&D focus and considers investments in R&D to be the main determinant of AC (Easterby-Smith et al., 2008; Lane et al., 2006; Lewin et al., 2011; Volberda et al., 2010). It is widely assumed that firms with high R&D efforts are better able to absorb external knowledge. In accordance with this assumption, the research mainly applies quantitative measures that rely on R&D expenditure or R&D personnel to operationalise and quantify AC (Lewin et al., 2011; Murovec and Prodan, 2009), even though the idea that R&D is an important predictor of AC has not been supported empirically (Flatten et al., 2011; Murovec and Prodan, 2009).

Another traditional assumption widely accepted in the literature is that AC is a function of the level of prior related knowledge. Prior knowledge includes skills, shared language, but also knowledge of the most recent technological or scientific trends and developments in a given field (Cohen and Levinthal, 1990). A firm’s knowledge base is built on prior investments in the individual absorptive capacities of its employees (Lane et al., 2006; Marabelli and Newell, 2014). In other words, organisational AC is affected by the individual stocks of prior knowledge possessed by individuals (Cohen and Levinthal, 1990; Minbaeva et al., 2003; Schmidt, 2010). Therefore, reemphasising the assumption regarding prior related knowledge, research often suggests that the larger the share of highly qualified personnel, the higher the firm’s AC (Schmidt, 2010; Vega-Jurado et al., 2008).

Furthermore, the construct of AC has been characterised as cumulative and path- or history-dependent (Cohen and Levinthal, 1990; Lane et al., 2006). If the firm has developed expertise in a certain area, it is more likely to search for new knowledge from domains closely related to this area (Laursen, 2012; Vega-Jurado et al., 2008). Existing expertise and experience facilitates learning and permits the firm to better understand and value new knowledge from a related area (Fosfuri and Tribó, 2008).
Previous research has also recognised that AC is a multi-level construct (Volberda et al., 2010). Cohen and Levinthal (1990), followed by, e.g. Lane et al. (2001), Van Den Bosch, Frans A.J. et al. (2003) and van Wijk et al. (2011), emphasise that, although AC is defined as an organisational construct, individuals are of high importance.

Following the arguments of Cohen and Levinthal (1990), several researchers investigated individual aspects of AC, mainly focusing on employees’ human capital. These included “general” aspects, such as formal education, qualification, and abilities, and “firm-specific” aspects, such as tacit knowledge, skills and experience developed at the workplace (e.g. Minbaeva et al., 2003; Schmidt, 2010; Teirlinck and Spithoven, 2013). Minbaeva et al. (2014) extended the HR perspective on AC by arguing that employees’ abilities are even more valuable when coupled with high motivation and opportunities.

The core underlying assumption is that highly qualified and highly skilled employees contribute significantly to building a firm’s knowledge stock. Following this line of argument, previous research considered employees with a high level of individual AC, such as R&D staff, scientists and engineers, to be the key promoters of organisational AC (e.g. Escribano et al., 2009; Veugelers, 1997). These key employees have a higher level of knowledge, are better at recognising opportunities, detecting and managing external knowledge flows, and are therefore more likely to generate new knowledge and know-how (Cohen and Levinthal, 1990; Lowik et al., 2017; Teirlinck and Spithoven, 2013). This is why firms with higher shares of such employees tend to have a higher level of AC (Grimpe and Sofka, 2009; Schmidt, 2010; Vega-Jurado et al., 2008).

In addition to human capital, several studies also emphasise the relevance of social capital for a firm’s AC (Lowik et al., 2017). Their higher social capital means that highly educated and skilled employees as well as managers function as interfaces between a firm and its external environment. They have links to external experts and therefore make it easier for a firm to access relevant external knowledge (Todorova and Durisin, 2007; Zahra and George, 2002). Besides this function, managers and key employees engage in information provision within the firm (Lenox and King, 2004). The research emphasises the important organisational roles of boundary spanners and gatekeepers (Cohen and Levinthal, 1990; Ter Wal et al., 2017; Volberda et al., 2010). These individuals scan the environment for relevant knowledge, bring it into the firm and
transform it so that other employees can understand and use it to develop new products, processes and services (Lewin et al., 2011).

Organisational component of absorptive capacity

While individual employees are the key drivers of a firm’s AC, organisational AC is not simply a sum of its individuals’ ACs. It also has a distinctly organisational component (Cohen and Levinthal, 1990; Lane et al., 2006; van Wijk et al., 2011). Therefore, mechanisms that convert the knowledge acquired by individuals to organisational-level knowledge play a crucial role in AC research (Cohen and Levinthal, 1990; Lewin et al., 2011; Song et al., 2018). Previous literature has explored such enabling organisational structures and distinguished diverse organisational capabilities and practices that foster information flows and knowledge sharing across organisational units and between individual employees. For example, Jansen et al., 2005; Kogut and Zander, 1992; Van Den Bosch, Frans A.J. et al., 1999 draw attention to combinative capabilities, including coordination, systems and socialisation capabilities. Other studies investigate single practices, such as cross-functional interfaces, participation in decision-making, job rotation, formalisation practices, and quality circles (e.g. de Araújo Burcharth, AL. de et al., 2015; Vega-Jurado et al., 2008). Following the notion of Cohen and Levinthal (1990) regarding the importance of investments in employees’ skills to enhance their individual AC, some studies underpin the high relevance of training and learning activities for a firm’s AC (Minbaeva et al., 2003; Murovec and Prodan, 2009; van Wijk et al., 2011).

Recent research argues that analysing AC at the level of individuals accounts for the heterogeneity in AC at the organisational level (Distel, 2017). There are, however, only few studies that explore the relationships between different levels of AC. In particular, scholars have paid only sparse attention to the role of individual absorptive capacities and their interplay with organisational AC (Lane et al., 2006; van Wijk et al., 2011; Volberda et al., 2010).
Distinctive characteristics of non-R&D firms

Despite the extensive academic attention paid to AC and the many attempts to refine and reconceptualise the concept, it has not been explored to its full potential (Volberda et al., 2010). The majority of studies did not examine the concept critically as a rule (Lane et al., 2006) or consider whether the underlying assumptions are also relevant for contexts other than the R&D-based one.

In light of these shortcomings, the previous research findings cannot be generalised to include firms without formal R&D. Due to its excessive focus on R&D and technological, science-based knowledge, previous AC research has not paid enough attention to sources of heterogeneity in AC, such as the nature of targeted external knowledge, the type of targeted innovation outcome, as well as the available resources and capabilities necessary to deploy the AC process. In fact, a firm’s strategy and innovation pattern have an impact on the nature of AC (Lane et al., 2006). Different types of innovation rely on different types of knowledge (Fitjar and Rodríguez-Pose, 2013). Accordingly, depending on its innovation objective, the firm determines which knowledge is relevant, valuable and worth acquiring and exploiting. Knowledge from different sources varies in its nature, complexity and level of applicability (Vega‐Jurado et al., 2008) and hence requires a specialised form of AC (Grimpe and Sofka, 2009; Murovec and Prodan, 2009; Schmidt, 2010). To develop specialised AC, the firm relies on different internal resources and organisational mechanisms (Bogers and Lhuillery, 2011). Depending on the business and innovation strategy, firms can mobilise different internal resources and create different organisational settings to deploy their AC.

Therefore, to understand and properly capture AC in firms that do not perform formal R&D, we have to look at these potential sources of heterogeneity and find out whether their manifestations in non-R&D firms deviate from large R&D-intensive firms operating in high-tech industries – the main focus of previous AC research.

Compared with R&D firms, non-R&D firms have markedly different characteristics (see Table 1). First, their structural characteristics differ in terms of industry affiliation, and firm size (Som, 2012). Non-R&D-intensive firms are predominantly SMEs (Arundel et al., 2008; 2015) and mainly present in mature, low- and medium-tech industries (Heidenreich, 2009). Their limited resources due to their absolute size shape the scope and the focus of their innovation activities (Dooley et al., 2017) and are expected to shape their approach to managing AC.
Table 1 Comparison of the specifics of non-R&D firms with the mainstream research on AC

<table>
<thead>
<tr>
<th>Potential sources of heterogeneity</th>
<th>Mainstream research on AC</th>
<th>Specifications of non-R&amp;D firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry affiliation and firm size</td>
<td>mainly large firms operating in high-tech industries (e.g. Lane and Lubatkin, 1998; Lenox and King, 2004; Mowery et al., 1996; Patterson and Ambrosini, 2015)</td>
<td>mainly SMEs in mature, low- and medium-tech industries (e.g. Arundel et al., 2008; Heidenreich, 2009; Hirsch-Kreinsen, 2015)</td>
</tr>
<tr>
<td>Targeted innovation outcome</td>
<td>dominant focus on product innovations; other fields of innovations are neglected (Bogers and Lhuillery, 2011; Murovec and Prodan, 2009)</td>
<td>prevalence of process, organisational and marketing innovations (Arundel et al., 2008; Kirner et al., 2009; Som, 2012)</td>
</tr>
<tr>
<td>Relevant knowledge</td>
<td>technological, research- or science-based knowledge from universities and research organisations (Song et al., 2018; Volberda et al., 2010)</td>
<td>high relevance of practical, experience-based, tacit knowledge from suppliers and customers (Tunzelmann and Acha, 2005)</td>
</tr>
<tr>
<td>Main human resources</td>
<td>highly educated and skilled employees (R&amp;D staff, scientists and engineers) as the main promoters of the AC process (Cohen and Levinthal, 1990; Minbaeva et al., 2014; Schmidt, 2010)</td>
<td>low share of highly educated personnel (Som 2012); innovations mainly rely on engineers and technicians, marketing employees and design staff, and production employees (Hirsch-Kreinsen, 2015)</td>
</tr>
<tr>
<td>Organisational embeddedness</td>
<td>excessive focus on R&amp;D efforts and the crucial role of the R&amp;D department (Easterby-Smith et al., 2008; Lane et al., 2006; Lewin et al., 2011; Volberda et al., 2010)</td>
<td>no R&amp;D department; innovation resources from different departments, such as manufacturing, marketing and design (Arundel et al., 2008; Hervas-Oliver et al., 2011)</td>
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</table>

Second, non-R&D and R&D firms show different innovation behaviour and pursue different innovation patterns (Hirsch-Kreinsen and Jacobson, 2008), which are argued to be widely independent of structural aspects, and of sectoral affiliation in particular (Som, 2012). Whereas the majority of research on AC concentrates on product innovations only (Bogers and Lhuillery, 2011), non-R&D firms do not always target product innovations. To survive strong cost competition in low- and medium-tech industries, these firms are more likely to rely on process, organisational and marketing innovations (Arundel et al., 2008; Heidenreich, 2009; Kirner et al., 2009; Som, 2012). In fact, firms with lower levels of R&D frequently concentrate their innovation efforts on production processes. Therefore, these firms are often referred to in the literature as “process specialists” (Hirsch-Kreinsen, 2015). Further, non-R&D-intensive firms also follow a “customer-oriented” or “market-driven” innovation strategy (Grimpe and Sofka, 2009; Santamaría et al., 2009) that aims at a rapid response to customer needs and takes advantages of market niches (Hirsch-Kreinsen, 2015). These fields of innovation, which do not usually originate from R&D activities, have been largely neglected by the previous research on AC (Bogers and Lhuillery, 2011; Murovec and Prodan, 2009).
Third, the knowledge base relevant for their innovation activities differs between non-R&D and R&D firms. Research on AC implicitly assumes technological, research- or science-based knowledge as the type of knowledge that firms possess internally or search for externally (Song et al., 2018). In contrast, the knowledge relevant to non-R&D firms is regarded mainly as “practical knowledge” (Hirsch-Kreinsen and Jacobson, 2008; Kastelli et al., 2018; Tunzelmann and Acha, 2005). In fact, low-tech innovations are usually not the outcome of the latest scientific or technological knowledge (Bender, 2008). These are more likely to rely on practical, experience-based, tacit knowledge (Heidenreich, 2009; Tunzelmann and Acha, 2005). Within the firm, new ideas are often generated in the context of ongoing operations. (Hervas-Oliver et al., 2011; Hirsch-Kreinsen, 2008).

To extend their internal resources and reduce the uncertainty associated with innovation activities, non-R&D firms engage in innovation networks, and cooperate with and source external knowledge from different partners (Rammer et al., 2009; Santamaría et al., 2009). Since the relevant knowledge of non-R&D firms is usually distributed across a range of technologies, actors and industries (Kastelli et al., 2018), the knowledge base of these firms can be characterised as distributed (Caloghirou et al., 2014; Hirsch-Kreinsen, 2008). Given the scarcity of R&D resources, the remarkable ability of non-R&D firms to bridge the gap between different knowledge domains can be considered the main source of new ideas (Caloghirou et al., 2014) and represents one of the key factors for their innovation and economic success (Bender, 2008). To search for new technological impulses, non-R&D firms rely primarily on customers or suppliers (Heidenreich, 2009). Industrial partners provide them with valuable practical information about innovative manufacturing techniques as well as insights into new technological developments and their applications. The knowledge provided by suppliers and customers is usually less complex, less abstract, more applicable (Vega-Jurado et al., 2008) and is easier to access directly and integrate internally than knowledge from research organisations. On the other hand, some non-R&D firms also access and utilise complex, science-based knowledge if this knowledge is of high strategic relevance to them (Bender, 2008; Som et al., 2013). Empirical findings show that the share of non-R&D firms relying on research-based knowledge for innovations is not high (16% compared to 34% among R&D firms), but not negligible (Weidner and Som, 2015). Regarding the existing research on AC, the literature often overlooks the fact that
different kinds of knowledge and different knowledge sources are associated with different types of specialised AC (Schmidt, 2010).

Finally, non-R&D and R&D firms differ in terms of the available innovation resources and capabilities. While the research on AC emphasises the crucial role of R&D departments and high shares of highly qualified, even scientific personnel (e.g. Escribano et al., 2009), non-R&D firms lack a formal R&D department and are characterised by a below-average share of highly qualified employees. Instead, non-R&D firms utilise innovative resources from different departments within the firm, such as manufacturing, marketing and design (Arundel et al., 2008; Hervas-Oliver et al., 2011) and draw on the competences of the staff responsible for the ongoing operations: engineers and technicians, marketing employees and design staff as well as production workers (Arundel et al., 2008; Hirsch-Kreinsen, 2015). The main ideas for innovations can be ascribed to a few key individuals in the organisation: managers and key knowledge workers (e.g. Hirsch-Kreinsen, 2008; Jones, 2006). Considering that many of the drivers of innovation performance are also drivers of a firm’s AC (Escribano et al., 2009), it is likely that, in the absence of an R&D department and dedicated R&D personnel, non-R&D firms devolve knowledge absorption to other departments (Bender, 2008; Som et al., 2013).

To summarise, since non-R&D firms differ from R&D firms in terms of their innovation behaviour, innovation objective, relevant knowledge base and internal resources and competences, it seems obvious that there must also be differences in how non-R&D firms identify, assimilate and exploit relevant external knowledge.

3 Research Design, Sampling and Method

Case Study design and approach

This paper empirically explores the phenomenon of AC in innovative non-R&D-performing manufacturing firms by applying an exploratory, qualitative research approach (Straus and Corbin, 1998). This research design was chosen as the appropriate strategy because the main goal of the paper is to reinvestigate the mature construct of AC in the new context (Edmondson and McManus, 2007). In the context of non-R&D firms, the concept has rather a nascent nature: there is only a small number of studies that explore AC in less technologically intensive environments beyond the R&D context (e.g.
Bogers and Lhuillery, 2011; Grimpe and Sofka, 2009; Moilanen et al., 2014; Spithoven et al., 2011). Additionally, this qualitative approach makes it possible to address the multi-level aspects of the AC construct and provides insights into the interplay between individual and organisational components of AC. The case study approach and design is summarised in Figure 1.

For the empirical setting, non-R&D-performing firms are defined as firms with no internal R&D activities in terms of R&D expenditure. An analysis of non-R&D-performing firms (in contrast to non-R&D-intensive firms) makes it possible to isolate R&D effects and highlight non-R&D-based mechanisms more clearly (e.g. Arundel et al., 2008; Rammer et al., 2009).

Figure 1 Case study approach (adopted from Yin (2006)).

Four cases were identified using theoretical sampling that target non-R&D-performing innovative firms in the German manufacturing industry. As the study aims at analytical generalisation (Yin, 2006), firms in the sample have different sizes and belong to different industries (see Table 2). To control for extraneous variation (Eisenhardt, 1989), all four firms have the necessary capability to absorb new technological knowledge. On the one hand, one of the main competitive advantages of the analysed firms (and this is common for non-R&D firms in general) is their ability to adapt and optimise their manufacturing processes by adopting and effectively using new manufacturing technologies. In this context, technological AC plays a crucial role for a firm’s success and competitiveness. On the other hand, all four firms have close contacts to universities and regularly participate in research projects, both technical and non-technical, with universities and other research institutes. This fact suggests that these firms possess the necessary competences and capacities to absorb research-based,
scientific information (cf. Murovec and Prodan, 2009). In previous research, this was considered an indication for a high level of AC (Cassiman and Veugelers, 2000).

In 2017, the primary data were collected in semi-structured qualitative interviews (Miles and Gilbert, 2005). Table 3 provides an overview of the number of interviews and interview partners. The interviews were recorded, transcribed and analysed. To assure the construct validity (Yin, 2006), additional sources of evidence were used for the analysis (internal documents, organigrams, presentations, informal conversations; as well as written materials and reports from previous research projects in which these firms were involved).

**Table 2 Description of companies**

<table>
<thead>
<tr>
<th>Case</th>
<th>Sector</th>
<th>Number of employees</th>
<th>Position in the value chain</th>
<th>Product complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Metal products</td>
<td>ca. 200</td>
<td>Supplier of parts/components</td>
<td>low to medium</td>
</tr>
<tr>
<td>B</td>
<td>Metal/plastic products</td>
<td>ca. 100</td>
<td>Supplier of parts/components</td>
<td>low to medium</td>
</tr>
<tr>
<td>C</td>
<td>Manufacture of furniture</td>
<td>ca. 450</td>
<td>Producer of finished goods</td>
<td>low to medium</td>
</tr>
<tr>
<td>D</td>
<td>Electrical equipment</td>
<td>ca. 50</td>
<td>Supplier of parts/components</td>
<td>rather low</td>
</tr>
</tbody>
</table>

Company A operates in the aluminium processing industry and is a supplier to the automotive industry. It produces technical extruded parts and assemblies. The core competences of this company lie in cold forming by impact extrusion combined with use of innovative processing techniques. The company develops its solutions according to customer needs and specifications.

Company B operates in the metal and plastics processing industry and produces technical parts for the mechanical engineering, automotive and aircraft industries. Its expertise is both machining metal using CNC machinery, and machining plastics by injection moulding.

Company C is an innovative manufacturer of furniture. Its main product is swivel chairs for a range of customer groups – end users, business customers, etc. Production comprises many individual steps; the internal logistic is strongly automated, whereas the pure manufacturing of the chairs consists of rather simple activities (packing, weighing, gluing).

Company D is a manufacturer of customer-tailored electric heating components. Its most important sales markets are the plastics industry and the general mechanical engineering sector.

In order to keep the scope of the investigation feasible, the interviews were structured around situations in which a firm needed external technological knowledge for a process innovation. AC was operationalised by focusing on organisational problem-solving activities embracing the search for relevant external knowledge, its absorption and deployment (adopted from Katila and Ahuja, 2002 and Laursen and Salter, 2006).

**Table 3 Interviews conducted**

<table>
<thead>
<tr>
<th>Case</th>
<th>Number of interviews</th>
<th>Length of interviews</th>
<th>Interviewed persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4 interviews</td>
<td>5 hrs in total</td>
<td>Two top managers,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Head of Technical Sales/Engineering,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Head of Construction/Toolmaking</td>
</tr>
<tr>
<td>B</td>
<td>1 interview</td>
<td>1 hr</td>
<td>Top manager</td>
</tr>
<tr>
<td>C</td>
<td>1 interview</td>
<td>1 hr</td>
<td>Top manager</td>
</tr>
<tr>
<td>D</td>
<td>2 interviews</td>
<td>2.5 hrs in total</td>
<td>Two top managers</td>
</tr>
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</table>
Qualitative content analysis

Qualitative content analysis according to Mayring (2017) was used to analyse the collected data. The category formation embraces both deductive and inductive aspects (cf. Gebauer et al., 2012; Horvat et al., 2018). In the first step, aggregated dimensions were derived from the literature. The interviews were analysed along the following two dimensions: personnel resources involved in AC (individual component of AC), and organisational mechanisms (organisational component of AC). These dimensions provided the orientation for an initial analysis of interviews and the identification of inductive categories. Following the “Gioia Methodology” (Gioia et al., 2013), 1st order concepts and 2nd order themes were inductively formed using MAXQDA software. Afterwards, they were matched with the deductively derived aggregated dimensions.

4 Findings and Discussion

Specifics of absorptive capacity in non-R&D firms

The first and main question guiding the empirical analysis was how non-R&D firms, which lack formal R&D activities and R&D personnel, manage the absorption of external technological knowledge, and whether their AC differs from that of R&D-performing firms.

When searching for external knowledge, the four firms generally aim at incremental innovation and conduct a “local search” (Laursen, 2012) targeting knowledge domains closely related to the firms’ current knowledge base. Focusing on “local” knowledge with low complexity but a high degree of applicability shapes how these firms deploy their AC and is reflected in the specifics of the AC process.

It is worth emphasising that the AC of non-R&D firms is not necessarily low level. On the one hand, the absorption of complex knowledge and distant search are also possible in a non-R&D context. Besides the fact that all four non-R&D firms rely on impulses from academic and research partners, the interviews reveal that Company C and Company D follow an explorative strategy that targets more distant knowledge domains. On the other hand, even if the inputs from a single external source are relatively straightforward in most cases, complexity arises from the “distributed knowledge base”. To find a solution to a technical problem, especially to a complex and nontrivial one, the analysed firms draw on impulses from a number of partners and diverse knowledge
sources. The interviewed firms stated a wide variety of different sources: scientific and professional online and printed publications, visits to trade fairs and professional events, active participation in networks and working groups, contacts to suppliers, customers, industry representatives, competitors, as well as to universities, research institutes, R&D offices and laboratories. To handle the complexity and find a novel solution, non-R&D firms definitely require sufficient AC. In the absence of formalised R&D processes, these firms have to make greater efforts to combine different impulses and apply more sophisticated organisational practices.

Further, the analysis of the interviews reveals that the AC process in the studied non-R&D firms is rather informal and more intuitive. This reflects the literature suggesting that innovations in non-R&D firms occur in a less strategical, more informal ad hoc way than is the case in R&D firms (e.g. Hirsch-Kreinsen, 2008). Nonetheless, this does not mean that they lack strategic planning (cf. Dooley et al., 2017), simply that their AC has a more emergent nature.

Linking these findings to the previous research on different types of AC and different types of search strategies, we can assume that the non-R&D firms commonly follow a “problemistic search” strategy (Laursen, 2012) that focuses on addressing a specific problem. Such a problem-driven, purposive approach to knowledge absorption is likely to be more affordable for non-R&D firms, considering their limited internal resources. Since this approach is not necessarily restricted to non-R&D firms only, this finding may open the discussion in AC research on whether striving for an optimum level of AC instead of a maximum level may be more reasonable, considering the costs of building AC (cf. Volberda et al., 2010).

In addition, the analysed firms not only actively search for new knowledge, but also passively receive relevant impulses from long-standing partners. Thanks to close, mutual relationships, suppliers and customers are familiar with the specific needs and technical scope of their non-R&D partners and inform them of relevant technologies and new trends. As the interviews show, this is particularly beneficial if the external knowledge is too theoretical and complex, and the knowledge base of the non-R&D firm is not sufficient for it to identify potentially valuable information on its own. Linking this finding to previous research, the firm’s suppliers and customers operate as “knowledge intelligence units” (Spithoven et al., 2011), monitoring and identifying relevant trends from academia and informing the non-R&D firm about them. In this setting, high-tech suppliers (or customers) possess AC oriented towards scientific, research-based
knowledge, and after processing this knowledge, provide low-tech partners with its more applicable form. As can be seen in Case B, universities can also undertake part of the knowledge absorption process. Spithoven et al. (2011) describe this function as acting as “knowledge agencies” that transform knowledge and technology on behalf of the non-R&D firms. It is worth emphasising that the analysed firms have to integrate the knowledge received on their own, in order to exploit it for their innovations. This would be not possible without key individuals and well-functioning organisational practices.

**Reliance on a few key individuals**

In the absence of a formal R&D department and R&D staff, different groups of employees with different qualification levels contribute to the process of knowledge absorption in the analysed firms. To absorb technological knowledge relevant for process innovations, the interviewed firms rely on managers and a handful of key employees, mainly engineers. This underpins the arguments that having the right mix of people leads to a greater AC (Duchek, 2015; Lowik et al., 2017; Marabelli and Newell, 2014).

In all four firms, the promoters of the AC process seem to have the power and opportunities not only to bring new ideas into the organisation, but also to promote and expedite their implementation (cf. Jones, 2006; Minbaeva et al., 2014). In accordance with the arguments on the importance of individual social capital for AC (Lowik et al., 2017), the key knowledge workers in the analysed firms have dense personal networks of contacts with diverse external partners and experience with sourcing knowledge in the form of previous participation in cooperation, joint projects, co-developments, or joint tests.

Moreover, employees with lower qualifications, such as master craftsmen or skilled production workers can be important promoters of AC during the integration and transformation phases. This underlines the argument that the skills required vary between innovation fields and technicians appear more relevant for incremental innovations, especially for process innovations (cf. Freel, 2005). Furthermore, in Companies A and B, management has recognised the importance of involving production workers in decision-making right from the phase of searching for the relevant technologies in order to ensure future acceptance of any new solution. This finding extends the existing AC research that only indicates the high relevance of highly educated employees. Lower qualified
employees have been largely neglected, even though they can be of high relevance for the absorption of tacit knowledge.

Table 4 Individual component of AC

<table>
<thead>
<tr>
<th>Themes</th>
<th>Illustrative quotes (translated from German)</th>
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<tr>
<td>Promoters of AC</td>
<td>“…this has strategic importance and depends on the management or technical sales.”                                                                                     (Case A, interview 1).</td>
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<td>“In principle, there are three central responsible persons. One is the production manager, the other is our purchasing manager and myself [top manager].” (Case C, interview 1)</td>
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<td>“An important instrument is a certain group of employees who deal with such projects. This is a group of eight people in total. And this group has the beautiful name Team Technology [...] because of their activity, since they have a lot to do with technology in their normal areas of responsibility.” (Case D, interview 1)</td>
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<td>Human capital</td>
<td>“And because of our size and niche orientation, we don’t change [our technologies] so often [...] because we only need very, very small partial innovations in order to be marketable again and again. That is what we do with the people we have. And I have to admit that we very often have to try things out. Think, plan, try, correct, if necessary.” (Case A, Interview 1)</td>
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<td></td>
<td>“There is a lot of demand for innovation from ourselves. Here, the people are very strong. So we have 4-5 really good people.”(Case C, interview 1)</td>
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<td></td>
<td>“Qualification is always good. If you also respect the fact that there are different people who can be organised in different ways and that teams are heterogeneous, then you can do a lot right with it.” (Case D, interview 1)</td>
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<td>Social capital</td>
<td>“From my first employment, I [Head of Construction/Toolmaking] have actually quite good contacts to different universities. [...] [It works] through personal contacts, because you are in this area for a while, you meet one or the other or you make a phone call [...] And that is how you come up with one or the other idea.” (Case A, Interview 4)</td>
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<td>“[We took the contact to the university] in our own hands, because we have employees who studied there and they then used their contacts.” (Case B, interview 1)</td>
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<td></td>
<td>“The purchasing manager, because he travels all over the world and gets an unbelievable amount of input. [...] Also the production manager. [...] And as I said, bigger trends are coming from my side [top manager], from the whole research environment, because I am involved in the very different research projects.” (Case C, interview 1)</td>
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<tr>
<td>Motivation and opportunities</td>
<td>“Then it is decisive how nutritious the soil is: the more qualified and motivated the employees are, the easier it is for something new to emerge. Even if you bring in something completely new. [...] That means a lot of process innovations come from us, from the abilities of our people.” (Company A, interview 1)</td>
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<td>“We want to follow what is new on the market, what is new on the technology front, from which I may not be able to profit today but tomorrow. So when the time comes, you study the relevant literature.” (Case A, interview 3)</td>
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<td>“[The motivation] was also high. Because a new machine, a modern control system means further development for the employees.” (Case B, interview 1)</td>
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<td></td>
<td>“Shift workers are often former workers, so they blossom incredibly and soak up new knowledge, and that of course inspires them to acquire knowledge by themselves. What they now research on the Internet, I found really exciting.” (Case C, interview 1)</td>
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**Integrating key employees by means of organisational practices**

Considering non-R&D firms lack a designated R&D unit and have only a small number of highly educated and skilled employees, their main challenge is how to use the resources of these key employees effectively and efficiently and to integrate the processes and tasks related to knowledge absorption into their daily operations. To tackle this challenge, the analysed firms deploy several organisational practices that enhance human capital, or the firm’s knowledge base, as well as strengthen the integration of individuals into the collective outcome. The greater the variety and complexity of the specific targeted knowledge, the greater the efforts firms have to undertake and the more important the role these practices play.

**Investment in qualifications to enhance individual absorptive capacity**

The more limited the personnel resources of non-R&D firms are, the more important the qualifications and competences of each single employee become. Firms can enhance their AC by investing in education, training programmes and qualification measures (cf. Cohen and Levinthal, 1990). Companies A and B mainly rely on necessary qualification measures with a task-specific focus for production employees. Companies C and D, on the other hand, provide their employees with opportunities to participate in diverse external training courses that have both a task-specific and an interdisciplinary focus in order to equip different groups of employees with the skills needed to meet new requirements and new market and technology challenges. The high importance of investments in human capital for a firm’s AC is in line with the previous literature on low-tech industries. For example, Santamaria et al. (2009) suggest that training is especially important for these firms, because their employees need hybrid qualifications and knowledge from different domains due to the distributed knowledge base (Santamaria et al., 2009).

**Purposeful positioning of boundary spanners**

The interviews with the companies demonstrate that non-R&D firms can overcome the challenge of limited personnel resources by positioning key players purposefully within an organisation. The position of key employees with relevant experience and expertise
determines what kind of knowledge flows into an organisation and how it is then transferred and used within it.

To recognise and assimilate relevant technological knowledge, the analysed firms rely on external boundary spanners and gatekeepers, especially managers and those with an academic degree. These promoters participate in external and internal networks and link external knowledge with the needs and requirements of the firm. In other words, they know where to search for valuable knowledge externally and how it could be relevant internally. From the interviews, it appears to be advantageous if the persons in this position have a good strategic perspective and a broad overview of organisational processes. This is in accordance with previous research (cf. Minbaeva et al., 2014).

Internal boundary spanners are relevant for knowledge transformation and exploitation. They function as an interface within an organisation and forge links between departments that have different expertise and “speak different languages”. For example, in Company A, such an interface is provided by master craftsmen who connect engineers with production workers. The existence of such an organisational role becomes more important with increasing problem complexity.

Cultivation of mechanisms facilitating intra-organisational information exchange

In the absence of a designated R&D unit, the process of absorbing technological knowledge in the analysed non-R&D firms is widely distributed across different departments: engineering and construction, production, procurement, marketing, sales and customer service. In general, even if the absorption process appears to be less structured and more intuitive, such broad anchoring can be advantageous for the firms considering that they rely on impulses from diverse external knowledge sources and can channel these impulses through different interfaces.

In order to disseminate knowledge effectively between different departments, firms rely on organisational mechanisms that stimulate intra-organisational information and knowledge sharing. It appears that the previously studied social integration mechanisms (e.g. de Araújo Burcharth, AL. de et al., 2015; Vega-Jurado et al., 2008; Zahra and George, 2002) are positively associated with AC in the analysed non-R&D firms as well. The four firms show a strong reliance on cross-functional teams, regular formal and informal communications between groups of employees involved in knowledge absorption, the participation of key employees in decision-making with
regard to the acquisition and integration of new technologies, as well as documentation of the main findings obtained during the process of knowledge absorption.

Alignment of organisational settings

In order to integrate the tasks and activities related to knowledge absorption into daily operations, the analysed firms have created (purposefully or intuitively) settings and structures favourable to developing AC. The data suggest it is beneficial if a firm officially assigns the formal responsibilities related to monitoring the external environment, learning and staying up-to-date to a particular (groups of) employees and dedicates working hours to these tasks, rather than considering them an activity for any spare time. Furthermore, Companies C and D demonstrate that an organisational culture is crucial that empowers employees, encourages experimentation, tolerates failures, and facilitates information flows.

An interesting distinction was found between the firms in terms of how to integrate key individuals into the AC process. The organisational AC of Company D can be seen as a pool, to which different employees contribute their individual ACs. In practice, this means that several employees from different functional areas are encouraged to search for external ideas to solve a concrete problem and then to channel them in a cross-functional interface. All relevant ideas are discussed during regular meetings. After the most promising solution has been collectively selected, a project team is put together to pursue this idea. By including different perspectives and professional backgrounds, Company D ensures access to different knowledge domains and is able to conduct not only narrow, problem-centred searches, but also distant searches for external knowledge. In Companies A and B, the organisational AC is more of a chain, which connects individual ACs sequentially. Key knowledge workers from engineering or construction are mostly responsible for knowledge acquisition and assimilation (and partly transformation), but its exploitation takes place in production. Accordingly, AC is organised as a sequence of tasks. Each employee in this sequence has their own specialisation, fulfils their task in the AC process and then passes it on to the next employee. The employees interact with each other only to hand over their results or if problems occur that cannot be solved without involving others.
### Table 5 Organisational component of AC

<table>
<thead>
<tr>
<th>Themes</th>
<th>Illustrative quotes (translated from German)</th>
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| Investments in qualifications               | “It only works if you work permanently on the skills, on the qualifications of the people involved. Not as a guided process, but that everyone is permanently aware of the developments and trends within their area of responsibility [...] That means the process developer for the tools must be in contact with the tool manufacturers, new cutting materials, new geometries, new production methods. The engineer must be in contact with the machine manufacturers. This is a permanent cycle that must not be interrupted.”  
(Company A, interview 2)  
“We put an incredible amount of money into it [in building IT competences]. That is the big topic, [...] you cannot do anything else than attend the trainings every 4 weeks.”  
(Case C, interview 1)  
“Today we have a meeting structure in the area of shift leaders and the next management level. So we use a train-the-college concept, for example. [...] Then there is a forced shift leader rotation [...] That expands the knowledge of these people incredibly.”  
(Case C, interview 1)  
“Under circumstances, they all also attend seminars and training courses, then of course come together with employees of other companies, for example. Basically, they always have the opportunity to learn things that can be useful to us via newsletters and other channels.”  
(Case D, interview 2) |
| Purposive positioning of boundary spanners   | “There is the engineer I mentioned, and he is responsible for the areas of tool construction, construction and simulation. [...] He is the one who maintains the contacts, coordinates the experiments, and coordinates the cooperation in the projects with any research institutes. And there are also all kinds of cooperation with suppliers.”  
(Case A, interview 1)  
 “[Process developers] are the link between the engineers and the masters in the workshop. And they are in-between.”  
(Case A, interview 2)  
“At the moment [the external knowledge flows into the organization] through me [top manager], [...] and then it is incorporated through these agile management meetings.”  
(Case C, interview 1)  
“And the smaller group discusses it from the technical side: where can we use it, whether it is feasible, how we integrate it in a certain process? In general, someone has an idea and plays it into the team meeting.”  
(Case D, interview 2) |
| Cultivation of mechanisms facilitating intra-organisational information exchange | “We have very good experience of simply combining skill sets in that we say ‘I have a process developer [...] Then I have a master toolmaker [...] And the construction department’. [...] Always bring these 3 areas to the table and say: ‘First, we develop a basic concept together. How do we want to approach this thing? How do we want to build the tool?’”  
(Case A, interview 4)  
“There is a team working together, always as a team. Because we have several interfaces that meet...”  
(Case A, interview 2)  
“This is discussed and assessed by representatives of different disciplines, who sit at the same table.”  
(Case D, interview 2)  
“What is the basic structure of a machine, what should come out of it, [...] where do we see risks, where do we see possibilities? If they [production workers] are already there mentally, they are a clear step further, when the machine comes and then accept the thing. Because if they don’t accept it, they say: ‘it is not mine, it is yours’.”  
(Case A, interview 1)  
 “… and of course these things are discussed again and again in our weekly meetings, what additional possibilities and ideas can be incorporated.”  
(Case B, interview 1)  
“There are a total of 5 structured meetings that run at different intervals. [...] By the way, this is our very big instrument, which has triggered fantastic developments: the exchange between the different groups regarding knowledge. That works well. This is how we anchor current knowledge in people’s heads.”  
(Case C, interview 1)  
 “… for trade fairs that have taken place, there is then documentation in the form of a trade fair report, where we record all the things that may be important to us and then consider what we can do with them.”  
(Case D, interview 1) |
(Table 5 Continued)

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<tr>
<th>Themes</th>
<th>Illustrative quotes (translated from German)</th>
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<tbody>
<tr>
<td>Alignment of organisational settings</td>
<td>“We are very task-oriented, so there are active tasks that are usually processed there. And if there is any time left or if there is a corresponding requirement, then it will be put on the table.” (Case A, Interview 3).</td>
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<td></td>
<td>“The people who organise production in the company, they have reserved part of their availability and time for questioning and further developing production as well. As a pool of ideas there are these regular meetings in the technical team.” (Case D, interview 1)</td>
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<td></td>
<td>“We can do a lot ourselves because we have a certain size. [...] That means I can really take one or two people completely off, even for a whole week, and I can have them trained.” (Case C, interview 1)</td>
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<td>“Due to our organisational structure, managing directors do not have much to do with day-to-day business, but have handed over responsibility to our employees. We defined our task in such a way that we are responsible for creating the right framework conditions so that the employees can do their job well. These are all important and necessary prerequisites for such a culture to emerge and to be effective. [...] To offer a completely open and positive information structure, i.e. to offer information, then to create the possibilities of regular meetings so that one can reach colleagues with their own ideas and suggestions.” (Case D, interview 1)</td>
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Taken together, the findings on the organisational components of AC in non-R&D firms reveal that, despite some commonalities across the four firms in their reliance on organisational mechanisms, these mechanisms are idiosyncratic to the respective firm in the specific way they are employed (cf. Eisenhardt and Martin, 2000). Each firm has its own optimal combination of several enabling mechanisms.

**Comparing findings for non-R&D firms with traditional assumptions**

The revealed findings for non-R&D firms challenge the traditional assumptions underlying the AC concept. First, it is widely assumed that a firm must invest in in-house R&D to absorb any of the R&D output, and therefore that R&D-intensive firms are better equipped to absorb external knowledge (Cohen and Levinthal, 1990). Based on the analysed data from the case studies, it appears that AC is possible and can be successfully developed without investments in formal R&D. Deploying sufficient AC does not rely solely on R&D efforts. The analysed firms rely on diverse functional areas to compensate the missing R&D function and successfully exploit diverse organisational practices that foster communication and knowledge sharing between different departments and facilitate the integration and exploitation of assimilated knowledge. Moreover, not all activities within an absorption process require R&D efforts (cf. Bogers and Lhuillery, 2011).
Second, a firm can succeed in acquiring, assimilating and exploiting relevant external knowledge even with limited personnel resources, especially with only a low share of highly educated personnel. On the one hand, a relatively low share of employees with university degrees can be compensated by positioning these employees effectively within an organisation to promote the AC process. On the other hand, the firm-specific tacit knowledge, experience and skills of employees rather than their formal qualifications seem to play a crucial role for non-R&D firms that pursue process innovations and rely on practical, applicable knowledge. Further enabling mechanisms include purposively enhancing human resources by means of qualification measures and training courses, encouraging employees to build personal external networks, and introducing an open, empowering corporate culture.

Third, the findings of the case studies challenge the assumption of path-dependency and the cumulative character of AC. The analysed non-R&D firms are able to overcome fixed trajectories and access distant knowledge domains even with limited personnel and financial resources. They are able to explore new technological areas on their own or by relying on the AC of long-standing external partners that provide them with relevant knowledge in “translated” form and help them with its assimilation. This ability to break traditional technological paths and go beyond familiar knowledge domains is becoming increasingly important for non-R&D firms, considering that recently even mature industries are experiencing rapidly changing market conditions and disruptive technological developments (Caloghirou et al., 2014).

5 Concluding remarks

This paper explores AC beyond the R&D context and provides empirical insights into the interplay between individuals and organisational practices based on the analysis of the data from case studies of four German manufacturing firms that do not perform internal R&D activities. The results reveal that non-R&D firms pursue an individual-centred way of absorbing external knowledge. Their AC is based on a few key individuals and broadly anchored in different departments. To succeed with only a few key knowledge workers, the analysed firms rely strongly on diverse organisational practices to effectively integrate individual capabilities into a collective outcome.

By highlighting the non-R&D perspective and combining the insights obtained from non-R&D firms with earlier research, this study broadens our understanding of AC
and its underlying mechanisms. The obtained findings are not necessarily specific to non-R&D firms only, but they do call attention to some aspects of AC that are under-researched in the mainstream literature dominated by a R&D focus. These aspects include AC in the context of process innovations, the absorption of tacit, embedded knowledge, the organisational embeddedness of the AC process beyond a R&D unit, and the reliance on external AC. Moreover, non-R&D firms provide valuable insights that question the traditional assumptions underlying the AC concept. Future research can benefit from further examining the underlying assumptions in different contexts.

Besides showing that AC can be managed without formal R&D, this study particularly highlights the interplay between individual capabilities and enabling organisational mechanisms that foster technological AC in firms without R&D. The multi-level perspective and further exploration of the links between the individual and organisational components of AC is crucial to advance the AC concept theoretically. Additionally, by looking inside the “black box” of AC in non-R&D firms, this study provides information on the individual-level aspects of AC and on organisational practices. Therefore, it complements the research on the microfoundations of AC (e.g.; Distel, 2017; Lowik et al., 2017; Sjodin et al., 2019) as well as the on process-based stream of AC studies (e.g. Duchek, 2015; Horvat et al., 2018; Patterson and Ambrosini, 2015).

In addition, the insights gained from the qualitative data analysis suggest that AC is a heterogeneous construct, and that a variety of successful AC patterns exist. Depending on the innovation objective and the nature of the relevant external knowledge, different specialised types of AC can be distinguished (e.g. Murovec and Prodan, 2009; Schmidt, 2010) that are linked to different mixes of resources and organisational mechanisms. Shedding light on the key enabling resources and mechanisms is an important contribution to the research on the antecedents of AC (e.g. Fosfuri and Tribó, 2008; Jansen et al., 2005; Lowik et al., 2017). Further investigation could be useful to discover how the organisational- and individual-level antecedents differ between different types of AC, for example, between supplier-oriented and research-oriented AC, or between a focused, problem-driven approach and a broader, “slack” (Laursen, 2012) approach to knowledge search and absorption. Additionally, the insights into enabling organisational mechanisms can contribute to the development of a more comprehensive measurement approach to capturing AC in quantitative research.
For practitioners, the study provides insights into the successful management of AC that can help to support strategic decision-making. It gives examples and useful impulses of non-R&D-based mechanisms and describes how firms can develop, manage and enhance their AC, and thereby increase their innovativeness. A better understanding of the underlying mechanisms of knowledge absorption will become increasingly important for firms, especially in light of the challenges posed by highly competitive, rapidly changing and turbulent environments, knowledge intensification, the growing complexity of industrial production processes, and digital transformation.
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