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Knowledge Sourcing Strategies and Their Impact on Organizational Performance

VALERIA KIISK

TALLINN UNIVERSITY OF TECHNOLOGY
School of Business and Governance
Department of Business Administration
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Supervisor: Dr Mait Rungi
School of Business and Governance
Tallinn University of Technology
Tallinn, Estonia

Oppnents: Prof Dr Marko Torkkeli
LUT School of Engineering Science
Lappeenranta-Lahti University of Technology, Finland

Associate Prof Dr Ana Isabel Fernandez Mesa
Department of Business Management
Faculty of Economics
University of Valencia, Spain

Defence of the thesis: 8 December 2020, Tallinn

Declaration:
Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology, has not been previously submitted for doctoral or equivalent academic degree.

Valeria Kiisk

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Teadmiste hankimise strateegiad ja nende mõju organisatsiooni tulemustele

VALERIA KIISK

TAL TECH
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Contents

List of Publications

The list of author's publications, on the basis of which the thesis has been prepared:

I Kiisk, V. (2019). The interplay between knowledge creation strategies: The case of European information-and-communications-technology firms. The IEEE International Conference on Engineering and Engineering Management (IEEM), Macao, China, 15-19 Dec 2019. (ETIS 3.1.)

II Kiisk, V., & Rungi, M. (2020). Knowledge cannibalism in the European ICT sector. *The Learning Organization,* 27(4), 305–319. (ETIS 1.1.)

III Stulova, V., & Rungi, M. (2017). Untangling the mystery of absorptive capacity: A process or a set of success factors? *Journal of High Technology Management Research*, 28(1), 110–123. (ETIS 1.1.)

IV Rungi, M., & Kiisk, V. (2020). Exploring the elements of absorptive capacity: Large scale interview study of 61 companies in Estonia. *International Journal of Transitions and Innovation Systems*, 6(3), 199–218. (ETIS 1.2.)

Author's Contribution to the Publications

Contribution to the papers in this thesis are:

I The author is the sole author of Publication I.

II In Publication II, the author was the main author, collected the data, carried out analysis of the results, wrote the manuscript in collaboration with the co-author.

III In Publication III, the author was the main author, participated in data collection, carried out analysis of the results, wrote the manuscript in collaboration with the co-author.

IV In Publication IV, the author was the second author, participated in data collection, carried out analysis of the results, wrote the manuscript in collaboration with the co-author.

Introduction

An increasingly dynamic business environment influences all market participants (Coombs & Bierly, 2006; Liu et al., 2019), forcing organizations to re-shape themselves, addressing the changes occurring (Levinthal & March, 1993). The knowledge possessed by an organization is a strategic asset, allowing it to establish and to sustain competitive advantage (Grant, 1996; Zacharia et al., 2011). Knowledge is an intangible resource, which is difficult to imitate (Grant, 2013) and which aims to create economic benefits (Agostini & Nosella, 2017). Thus, long-term corporate success is shaped by organizations' commitment to expanding their knowledge base.

New knowledge can be sourced internally or externally (Eisenhardt & Santos, 2002). Internal knowledge sourcing normally includes in-house research and development (R&D), resulting in unique knowledge being developed, while external knowledge sourcing may include market-monitoring practices, benchmarking against competitors, collaboration with other companies – via partnership, joint ventures or corporate combinations, e.g. merger and acquisition (M&A) transactions (Levinthal & March, 1993; Wang & Zajac, 2007). Although certain knowledge can be developed internally, it is argued that some knowledge can only be obtained through external sourcing (Lichtenthaler, 2016).

The distinction between internal and external sources of knowledge is widely accepted (Pereira et al., 2019). Moreover, there is an understanding that the two dimensions interact (Bertrand & Mol, 2013; Lewin et al., 2011; Swift, 2016). The two knowledge sourcing strategies have been seen earlier both as complementary (Benson & Ziedonis, 2009; Sahaym et al., 2010) as well as opposites (Bertrand & Mol, 2013). Zacharia et al. (2011) highlighted the importance of internal knowledge in recognizing of external opportunities, while Posen and Chen (2013) showed that the internal learning process also facilitates the intake and use of external information. Emphasizing their complementarity, Lichtenthaler (2016) demonstrated that there are other aspects to this – some knowledge can be substitutive rather than complementary.

Attempting to diversify available opportunities and reduce the risks arising from market turbulence, companies try to balance between internal and external knowledge souring (Ben-Oz & Greve, 2015; Zollo et al., 2002), combining them to maximize performance (Martin-de Castro, 2015). Monteiro et al. (2017) proposed that there are synergies between the two, with strength in both resulting in superior overall performance.

Both strategies are believed to be beneficial for organizational performance (Weigelt & Sarkar, 2012), but there is no consensus on which is more beneficial (Agostini & Nosella, 2017). Building on the general premise of knowledge being path-dependent, Carlo et al. (2012) demonstrated that all innovation is based on internal knowledge, undermining the impact of externally sourced information. The same was advocated by Swift (2016), who posited that internal knowledge sourcing allows endeavors to be directed in a more targeted manner. Liu et al. (2019), on the contrary, argued that superior knowledge is difficult to develop internally, suggesting the superiority of external sourcing. External knowledge sourcing, especially via corporate combinations, grants rapid access to new knowledge, enabling easier and more beneficial capitalization on it (Ahuja & Katila, 2001). While advocating the complementarity of these strategies, Benson and Ziedonis (2009) argued that external knowledge sourcing provides higher returns.

Whatever knowledge sourcing strategy organizations use, it is their actual ability to make use of new knowledge that attracted more attention in earlier research. Absorptive capacity (ACAP) is a dynamic capability that is often adopted as a lens for knowledge-related

studies, helping organizations actually benefit from the knowledge sourcing (Zacharia et al., 2011), integrating the elements involved (Martin-de Castro, 2015).

ACAP allows companies to "recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990, p. 128). ACAP posits that external knowledge sourcing is founded on the internal knowledge stock, helping companies improve the combined knowledge base (Lane et al., 2006; Martin-de Castro, 2015). Seen as a central element in the sourcing of external knowledge, ACAP allows the threats stemming from external turbulences (Leonard-Barton, 1992) to be translated into new opportunities (Song et al., 2005), while also tackling internal knowledge sourcing and development (Baškarada, 2016).

Introduced by Cohen and Levinthal (1989), ACAP has been enthusiastically adopted by scholars. Despite gaining solid academic interest, there is still, however, considerable ambiguity with respect to this phenomenon, leaving room for interpretation (Maldonado et al., 2019; Todorova & Durisin, 2007; Van den Bosch et al., 2003) as a fair portion of earlier literature has paid this little attention and failed to advance the knowledge regarding this phenomenon (Lane et al., 2006).

As is the case with most knowledge-related phenomena, ACAP is an intangible concept, difficult to measure (Jimenez-Barrionuevo et al., 2011). Thus, the research on this topic is undermined by the use of proxies (Murovec & Prodan, 2009). Further, earlier research on ACAP has identified several challenges and research gaps. There have been numerous conceptual developments to the original model of ACAP, as introduced by Cohen and Levinthal (1989, 1990) (e.g. Heeley, 1997; Lane et al., 2001), but there has been little progress in developing a universally accepted model (Daspit, 2012). A model alteration proposed by Zahra and George (2002), which includes division of the phenomenon into two subsets – potential and realized ACAP – has acquired the most empirical evidence in subsequent studies (e.g. Fabrizio, 2009; Fosfuri & Tribo, 2008). However, there have also been concerted efforts to develop a new conceptual model. In this context, Sun and Anderson (2010) argued that every dimension of ACAP is a separate capability, while Marabelli and Newell (2014) argued the opposite, that the dimensions are complementary and non-linear in their nature, undermining the premise of a step-wise process for ACAP. With lack of agreement on the mechanism underpinning the phenomenon, researchers still agree that ACAP is a potentially powerful construct (Van den Bosch et al., 2003) and one not yet used to its full potential (Volberda et al., 2010).

Without consensus on the dimensionality, most studies concur that ACAP is a performance-enhancing concept (Maldonado et al., 2019), demonstrating a significantly positive impact on a broad range of organizational performance indicators – such as innovation (Cohen & Levinthal, 1990; Fabrizio, 2009), competitiveness (Winter, 2003; Zahra & George, 2002) and financial performance (George et al., 2001; Tsai, 2001). At the same time, other patterns of impact on organizational performance have also been observed. Several earlier works have stressed that the relationship is curvilinear, or U-shaped (Lichtenthaler, 2016; Rothaermel & Alexandre, 2009; Wales et al., 2013), meaning that some level of ACAP is necessary to benefit from learning, while possessing it over a certain level can be performance-deteriorating. Further, there has been evidence of the negative influence that this capability has on performance, as demonstrated by Knott (2008) and Hitt et al. (1991), based on the inelasticity of knowledge (Kumar, 2009).

In summary, the ambiguity around the relative benefits of knowledge sourcing strategies, as well as the limited insight into the mechanisms underpinning the knowledge sourcing, call for attention and further investigation. This thesis attempts **to establish**

which of the knowledge sourcing strategies – internal or external – is more beneficial for organizational performance and elaborates on the structure and outputs of ACAP, the central capability behind knowledge sourcing. The research gaps addressed in this thesis are summarized in Figure 1, which leads to the research questions. The research focuses on the organization as a unit of analysis. In measuring the relative benefits of knowledge sourcing, financial performance is used as the main measure.

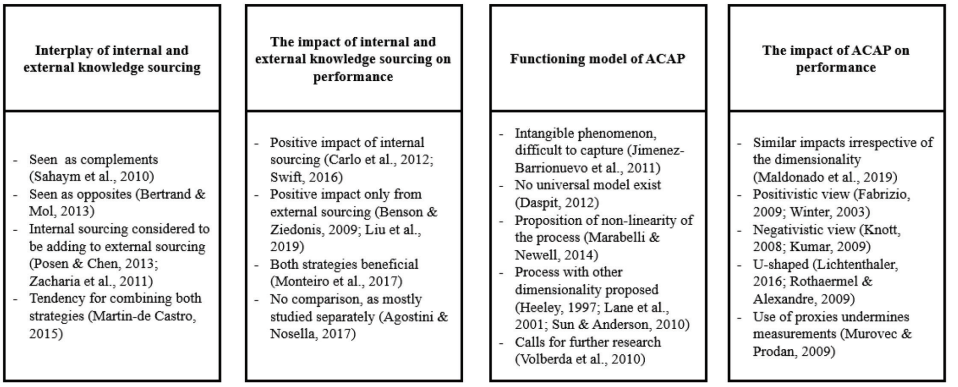

Figure 1. *Research gaps identified.*
Source: Composed by the author.

Accordingly, the following research questions (RQs) have been formulated:

- RQ1. How are internal and external knowledge sourcing strategies related?
- RQ2. How much do the internal and external elements of knowledge sourcing impact organizational performance?

Based on the analysis conducted, this thesis reveals that an external knowledge sourcing strategy is rather value-deteriorating, negatively impacting organizational performance. The thesis proceeds to further investigate ACAP as the core capability underpinning knowledge sourcing, which is especially important for external knowledge sourcing. The research attempts to provide understanding of the exact process behind ACAP and how it impacts organizational performance, leading to the following RQs:

- RQ3. If the original model of ACAP needs further development, what framework could be proposed?
- RQ4. How much does ACAP impact organizational performance?

Addressing the research questions above, this doctoral thesis is based on four separate publications (referred to throughout as Articles I-IV, please refer to the Appendix for full details). The publications are interrelated and jointly provide a coherent investigation of the topics raised, contributing to the RQs as well as the central goal of the thesis. Every research question is addressed using two to three articles.

The research implements a mixed method methodology, adopting both quantitative and qualitative research methods, and triangulating the results obtained. The empirical part is based on three datasets, structured to reveal different perspectives, from general to more specific. The interplay between the knowledge sourcing strategies and their relative benefits for performance (RQ1, RQ2) uses a database-derived sample of

information and communications technology (ICT) companies operating across the European Union. Consequent elaboration on ACAP (RQ3, RQ4) is based on two separate samples of profit-seeking companies in Estonia, with no particular sector focus – one collected through online surveys and the second via personal interviews.

The mix of quantitative techniques implemented includes *t*-test, longitudinal panel data analysis, exploratory factor analysis, Bayesian technique, multi-dimensional scaling and ordinary least squares regression. The qualitative technique was based on a large-scale interview study. Every construct and variable studied was measured with several variables, allowing results to be cross-validated and peculiarities to be sought. The samples used are generally balanced and the results obtained allow conclusions to be drawn in relation to the research questions posed.

By examining the interplay between, as well as the relative benefits provided by, internal and external knowledge sourcing strategies, this thesis advances the literature on knowledge sourcing. Although demonstrating certain complementarities, the internal and external dimensions of knowledge sourcing behave very differently. Further, the thesis demonstrates that both internal and external knowledge sourcing strategies are seemingly value-deteriorating as opposed to improving organizational performance, with a stronger and more persistent negative impact stemming from internal knowledge sourcing. Despite having a negative impact on performance, internal knowledge sourcing contributes to internal process improvements and efficiency gains within the organization. Another contribution of the thesis includes a proposal on further development of the ACAP model. The proposed model represents a shift from a sequential connection to a simultaneous combination of co-existing elements: continuing development, bottom-up innovation, trust-based internal cooperation, deferred knowledge use. This model suggests that the elements work simultaneously, but that there is a certain hierarchy within this, with organizations focusing most on the continuing development subset. One of the elements proposed – continuing development – adds to the organizational performance the most and also receives the most attention from firms.

In addition, this thesis has practical value in that it can help companies to structure their knowledge sourcing strategies. It outlines the options on which companies can focus in their quest for long-term competitiveness. Although the strategies do support one another, this support is limited, and investing in one of the strategies does not automatically improve the other. Both knowledge sourcing strategies can be performance-deteriorating. To achieve maximized performance, companies should balance between internal and external strategies, while focusing on continuing development, enhancing their products and services, and searching for new opportunities.

This thesis is structured as follows. The following section provides theoretical foundations, summarizing existing knowledge on the topic. Next, the methodological approach is described, followed by the results and conclusion. The publications on which the thesis is based are provided in the Appendix.

Abbreviations

ACAP	Absorptive capacity
BDM	Bayesian dependency modelling
EFA	Exploratory factor analysis
EU	European Union
ICT	Information and telecommunications technology
M&A	Mergers and acquisitions
MDS	Multidimensional scaling
OLS	Ordinary least squares regression
RQ	Research question
R&D	Research and development

1 Theoretical foundations

1.1 Background theories

Up until the mid-1990s, the business environment was characterized as stable, meaning that an organization's access to superior resources determined its competitive advantage (Barney, 1991). This earlier view suggested that success was pre-determined in a situation where the firm possesses some unique resources that are inimitable, resulting in sustained above-average performance (Peteraf, 1993). Later, the resource-based view was advanced further, to cater for the increased role of knowledge in securing a competitive edge (Grant, 1996; Nonaka, 1994) and allowing environmental changes to be addressed (Grant, 1991). Knowledge as a strategic resource is difficult to imitate (Grant, 2013), suggesting that firms with strong capabilities around knowledge are more likely to secure a long-term advantage (Teece, 2007). Although receiving a certain amount of criticism due to the lack of dynamics (Kapoor & Aggarwal, 2020), favouring intangible assets over the usual profit-orientation (Foss, 1996) and even not satisfying all criteria to be formally called a theory (Kaplan et al., 2001), the knowledge-based view effectively describes knowledge as an organizational factor (Koc, 2007), allowing companies to re-create themselves and knowledge creation to be translated into economic benefits (Agostini & Nosella, 2017).

The knowledge-based view has been extensively used in studies of knowledge sourcing and ACAP within organizations (Lichtenthaler, 2016; Un, 2017; Zacharia et al., 2011). This theory distinguishes between two major sources of new knowledge – internal and external (Eisenhardt & Santos, 2002). Internal sourcing covers processes such as in-house R&D and the development of proprietary knowledge, while external knowledge sourcing can include a variety of practices, ranging from market monitoring to corporate acquisition (Levinthal & March, 1993; Wang & Zajac, 2007). The ability of a firm to integrate internal and external knowledge through the creation of new knowledge is the main source for long-term competitiveness (Un, 2017). Mere access to internal and/or external knowledge is not sufficient for an organization to derive benefits from it – the organization has to have capabilities to integrate these flows into their processes, signifying the central role that ACAP plays in advancing and commercializing the knowledge stock, stemming from internal endeavours or the uptake of external knowledge (Martin-de Castro, 2015).

ACAP is a dynamic capability (Zahra & George, 2002), which also links knowledge-related studies to this theory. Having its roots in the resource-based view, the dynamic capabilities' theory arose following the separation of resources as tradeable assets and capabilities, the unique traits organizations develop, which enable organizational development (Makadok 2001). The flexibility around these traits enables companies to re-create themselves in every competitive situation, also through learning (Teece et al., 1997).

In addition, knowledge and ACAP have also been studied within organizational learning theory (March, 1991), which, among other things, allows shifting between different units of analysis as well as linking the studies to the 4I (intuiting, interpreting, integrating and institutionalizing) model (Crossan et al., 1999). Further, knowledge and ACAP are sometimes investigated via the lenses of innovation, project management and co-evolution theories (Volberda et al., 2010).

1.2 The interplay between the knowledge sourcing strategies

The knowledge-based view distinguishes two sources for the creation of organizational knowledge: internal and external (Eisenhardt & Santos, 2002). While some of the knowledge can be generated through internal efforts, a certain part of new knowledge still has to come from outside the organization (Lichtenthaler, 2016).

Earlier literature concurs on the division of knowledge into that developed internally and that taken from outside (Pereira et al., 2019). Adoption of the ACAP lens is relevant here because similar to the general propositions regarding the division of the sources of knowledge, advocated by the knowledge-based view, ACAP has also been divided into internal and external dimensions, implying that different routines are needed to process and manage internal and external knowledge, and suggesting that both are crucial for company development (Lewin et al., 2011; Lichtenthaler, 2016). The ACAP lens helps demonstrate that access to knowledge alone does not result in commercial benefits, an organization has to have capabilities to apply the newly synthesized knowledge (Martin-de Castro, 2015). While most ACAP studies revolve around the intake of external knowledge, there is also respective research on internal knowledge sourcing (Baškarada et al., 2016). In the long run, organizations may attempt to combine and balance the strategies (Ben-Oz & Greve, 2015). Nevertheless, while ACAP depends on the effectiveness of the knowledge governance mechanisms within the organization, it plays a crucial role in both types of knowledge sourcing (Pereira et al., 2019). Some studies have also suggested that there is no universal ACAP in an organization; rather, that there are several sub-elements targeting particular knowledge fields (Lichtenthaler, 2016).

Earlier research has provided evidence for the interplay between internal and external knowledge sourcing strategies (Bertrand & Mol, 2013; Lewin et al., 2011; Swift, 2016). These strategies have been seen as complementary (Benson & Ziedonis, 2009; Sahaym et al., 2010), stretching even to substitutivity in certain cases (Lichtenthaler, 2016; Weigelt & Sarkar, 2012). Posen and Chen (2013), as well as Benson and Ziedonis (2009) argued that internal learning processes facilitate the intake and use of information available externally, thus also simplifying the recognition of external opportunities (Zacharia et al., 2011). Swift (2016) argued that strong internal knowledge is a pre-condition for successful knowledge sourcing from outside. Maldonado et al. (2019) and Carlo et al. (2012) stressed that knowledge is path-dependent, suggesting that an external knowledge sourcing strategy can only be beneficial if internal knowledge is strong. Expanding the argument further, Sahaym et al. (2010) argued that internal R&D projects and corporate acquisitions are substitute strategies in developing new capabilities – with internal knowledge accumulation being slower and inflexible, while corporate acquisitions allow for more dynamism.

At the same time, there is also a contrasting opinion on strategies having a very distinct nature (Wales et al., 2013). Swift (2016) argued that internal knowledge development can be more beneficial, helping direct endeavors effectively, although sometimes organic investments demonstrate returns with a significant time lag (Singh & Montgomery, 1987). Meanwhile, Bierly et al. (2009) and Basuil and Datta (2017) advocated the superiority of external knowledge sourcing – especially in light of the prompt access to new knowledge that corporate acquisitions create (Ahuja & Katila, 2001). This ability to derive knowledge from business combinations has even been discussed as a new routine for external knowledge sourcing (Basuil & Datta, 2017).

Organizations mostly strive to combine internal and external knowledge sourcing (Ben-Oz & Greve, 2015; Zollo et al., 2002), maximizing the benefits provided by both strategies (Martin-de Castro, 2015). Monteiro et al. (2017) highlighted that there are

synergies between the strategies, demonstrating that openness to external knowledge, along with internal R&D and the availability of qualified labor as a boundary condition, enhance a firm's combinatory search, driving innovation.

1.3 The relative impact of knowledge sourcing strategies on performance

Both internal and external knowledge search strategies are considered beneficial for organizational performance (Weigelt & Sarkar, 2012), but there is little insight regarding their relative benefits as the strategies are mostly studied separately (Agostini & Nosella, 2017).

Organizations try to combine the strategies, diversifying available opportunities (Ben-Oz & Greve, 2015; Zollo et al., 2002) and striving for higher performance (Monteiro et al., 2017). There remain, however, arguments for the superiority of separate strategies. In this context, Benson and Ziedonis (2009) demonstrated that while the strategies support one another, persistent patterns of external knowledge sourcing create relatively higher returns. Liu et al. (2019) even argued that superior knowledge with high value development potential comes from a broad sourcing, i.e. it cannot be developed internally. The intake of external information can take various forms – starting from general market search practice to gaining access to external knowledge via the acquisition of other firms. Acquiring another company grants prompt access to valuable resources, including the knowledge in the firm's possession (Ahuja & Katila, 2001), allowing a combined entity to achieve improvements in productivity and performance (Anand & Singh, 1997). Bergh and Lim (2008) demonstrated that the success of corporate restructuring activities (spin-offs, sell-offs) is to a considerable extent driven by the knowledge processes and more particularly, the ACAP of a firm.

At the same time, Carlo et al. (2012) reaffirmed that knowledge is path-dependent, and that innovation can only come from proprietary knowledge, thus securing a competitive edge for an organization. Similarly, Swift (2016) argued that internal knowledge sourcing allows endeavors to be directed in a more focused manner, targeting the most promising areas, without the need to screen all available opportunities existing externally.

1.4 The ACAP model

The concept of absorptive capacity was pioneered by Cohen and Levinthal (1989, 1990), who defined it as the organizational ability to "recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990, p. 128). They envisaged a three-step process underpinning the phenomenon (please refer to Figure 2), which creates new links within an organization, making the capability unique to the organization, not the individuals. They proposed that ACAP is dynamic in its nature and acts as a key to innovation.

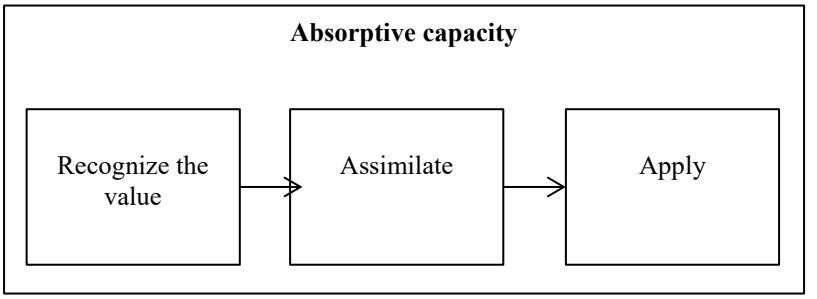

Figure 2. *The model of ACAP as proposed by Cohen and Levinthal (1989, 1990).*
Source: Composed by the author based on Cohen and Levinthal (1989, 1990).

A further advancement was offered by Zahra and George (2002), who stressed that ACAP is a firm-specific dynamic capability, or a "set of organizational routines and processes by which organizations acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability" (Zahra & George, 2002, p. 186). They suggested subdividing the four-step process into two subsets, differentiating between potential ACAP (what the organization could achieve given its level of knowledge) and realized ACAP (what is actually achieved) (please refer to Figure 3).

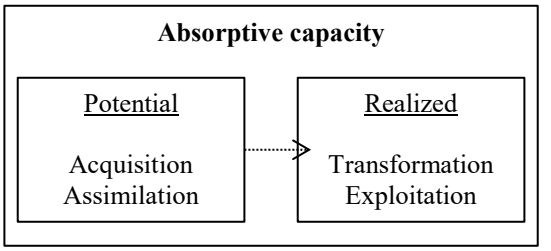

Figure 3. *The ACAP model as proposed by Zahra and George (2002).*
Source: Composed by the author based on Zahra and George (2002).

The model suggested by Zahra and George (2002) has been largely welcomed by scholars, receiving a certain amount of subsequent empirical validation (e.g. Flatten et al., 2011b; Fosfuri & Tribo, 2008). However, some deficiencies have also been stressed, undermining the use of the concept (e.g. Van den Bosch et al., 2003; Volberda et al., 2010). Several re-interpretations of the models have been proposed (e.g. Marabelli & Newell, 2014; Matusik & Heeley, 2005) – still with little consensus in academic circles on what a functioning model could be. Major discussions have evolved with respect to the dimensionality of the phenomenon as well as the sequence of the process (Heeley, 1997; Lane et al., 2001), which suggests the non-linearity of the phenomenon (Marabelli & Newell, 2014).

Despite numerous calls for further research, little contribution has been made in the recent years. Berghman et al. (2013) demonstrated that, while being an important determinant of innovation, ACAP is not a by-product of learning, but a capability that needs deliberate attention and accumulation – emphasizing the importance of the phenomenon. Monteiro et al. (2017) stressed that ACAP in general, and openness to external knowledge in particular, enhances an organization's combinatory search, which, in turn, adds to innovation. They established the availability of financing for internal R&D and access to qualified human resources as a boundary condition for this connection, linking the phenomenon to the internal micro-foundations within a firm.

While studying a classical relationship between ACAP and innovativeness (Ahuja & Katila, 2001; Cohen & Levinthal, 1990), Cepeda-Carrion et al. (2012) demonstrated that an unlearning context (i.e. organizational forgetting) is an instrumental factor influencing both potential and realized ACAP – implying that, before triggering learning, an organization has to internally select the most beneficial pieces of knowledge upon which to build the learning, forgetting the rest.

In summary, there have been calls for more research, especially qualitative (Maldonado et al., 2019; Volberda et al., 2010) and for works connecting conceptual and empirical contributions (Marabelli & Newell, 2014; Van den Bosch et al., 2003), demonstrating the need to obtain more in-depth understanding of the phenomenon, including its antecedents.

1.5 The impact of ACAP on organizational performance

Earlier studies have revealed the benefits of ACAP for various organizational performance indicators, being seen mainly as a direct, significant and positive determinant of, for example, innovation (Fabrizio, 2009; Tsai, 2001), competitiveness (George, 2005; Winter, 2003) and financial performance (George et al., 2001, Rothaermel & Alexandre, 2009). ACAP has also been demonstrated to be a determinant of the ability to use less commercialized knowledge, such as that stemming from R&D (Lane et al., 2006). In addition, it has been demonstrated to play a central role in determining the success of alliances and knowledge transfer within networks (Kim & Inkpen, 2005). Organizational performance is a wide term that can be interpreted differently based on the context of the study (Richard et al., 2009). Although various output indicators have been used in ACAP-related studies, financial performance is viewed as the main result, with other performance indicators treated mostly as mediators (Pereira et al., 2019).

Despite the prevalence of the view that ACAP positively affects performance, there is also evidence of ACAP having a mixed effect, being curvilinear or having an inverted U-shaped form – adding to performance at a low level, while being inferior and making knowledge inelastic when ACAP is too well-developed (Rothaermel and Alexandre, 2009). Assessing the impact of ACAP on various performance indicators, Maldonado et al. (2019) concluded that financial performance is the main result, with other measures (e.g. innovation) acting as mediators. Knott (2008) discovered an inverse relationship between returns and R&D spending, a classical operational measure for ACAP. She argued that the relationship was guided not by ACAP, but rather by an innate ability of a company, implying that companies that have higher returns invest in R&D more (and not the opposite).

Further, maintaining a higher level of ACAP is associated with certain costs, which are typically ignored in research and which can lead to value-distortion (Wales et al., 2013). Adding to this, Zhou and Wu (2010) proposed the concept of organizational inertia – when the ACAP level is high and a certain stable level of innovation has been achieved. Building further on this, Cepeda-Carrion et al. (2012) demonstrated that organizational forgetting is instrumental to the successful implementation of ACAP. Furthermore, Knott (2008) argued that ACAP is inferior to organizational performance, turning the relationship over – arguing that more successful companies tend to focus on knowledge accumulation more than less successful ones.

The lack of consensus regarding the direction of impact suggests the need to assess the benefits of ACAP vis-à-vis organizational performance, more specifically financial performance, as the final goal of organizations is usually profit generation.

2 Research methodology

2.1 Philosophical foundations

The methodological choices are grounded in epistemological realism, applying the positivist framework, assuming that there is only one objective reality. Positivism implies that scientific knowledge forms valid knowledge (Larrain, 1979) and that reality is "neither more nor less than what is given in the empirical world, because every meaning is uniquely determined thereby" (Weinberg, 2013, p. 56).

The positivist approach assumes that the world is "a finite but unbounded collection of mutually independent facts" (Weinberg, 2013, p. 67). The central role of research is making statements about reality and then proving or rejecting them based on the data collected (Creswell, 2003).

The main strength of positivism is its determination to discover solid causal explanations for facts, allowing their testability – it places empirics in the center, being an ontologically strong approach (McKelvey, 2003). However, it has also been argued that science might not be cumulative (Van de Ven, 2007) and that the positivist approach might be too narrow in behavioral sciences or complex phenomena (Vafidis, 2007). Positivism is well-suited for quantitative studies (Vafidis, 2007) and can also be applied in qualitative research, especially in the case of a design including several cases/organizations, viewed as a collection of experiments (Yin, 2003).

The data used in this research is based on sample companies' experiences, collected quantitatively or qualitatively; thus, the meanings to the phenomena studied are assigned by the subjects (Carsrud & Brännback, 2014). The role of the researcher is to be isolated from the phenomenon studied, not influencing it, and to assign meaning to the observations based on the objective truth. Thus, the author of this thesis seeks for causal explanation, based on the empirics collected and experiments conducted (McKelvey, 2003).

2.2 Research methods

It has been argued that quantitative research prevails in fields that are well-developed (Daft, 1995). Although knowledge-related questions have received considerable research attention, they are still far from being a well-developed research avenue. Numerous calls have been made both for empirical and theoretical contributions (e.g. Maldonado et al., 2019; Martin-de Castro, 2015; Todorova & Durisin, 2007).

To capture the richness of knowledge sourcing and ACAP, this thesis tackles several research questions. The analytical part of the thesis is based on a combination of various quantitative and qualitative methods used both simultaneously and in parallel, cross-validating and triangulating the results obtained (Van de Ven, 2007). The thesis is based on four separate publications, each addressing two to three research questions.

A mixed method approach, integrating quantitative and qualitative data, allows a rich insight into the phenomenon studied to be provided (Creswell & Plano Clark, 2011). Thus, a combination of methods was applied for most of the research questions, as detailed further below. Table 1 provides a summary of the research questions and methods, as well as the research samples used to tackle them.

Table 1. *Research questions and methods used*

	RQ	Methods used	Sample used
1	How are internal and external knowledge sourcing strategies related?	a. Quantitative study: *t*-test analysis (Article I) b. Qualitative study: a large-scale interview study (Article IV) c. Quantitative study: longitudinal data analysis (Article II)	a. 425 European ICT companies owning patents b. 62 interviews with companies in Estonia c. 123 European ICT companies owning patents and M&A experience
2	How much do the internal and external elements of knowledge sourcing impact organizational financial performance?	a. Quantitative study: longitudinal data analysis (Article II) b. Qualitative study: a large-scale interview study (Article IV)	a. 123 European ICT companies owning patents and M&A experience b. 62 interviews with companies in Estonia
3	If the original model of ACAP needs further development, what framework could be proposed?	a. Quantitative study: a combination of exploratory factor analysis, Bayesian dependency modelling and non-metric multidimensional scaling to determine the dimensionality of ACAP (Article III) b. Qualitative study: a large-scale interview study to validate the dimensionality of ACAP (Article IV)	a. 135 companies in Estonia b. 62 interviews with companies in Estonia
4	How much does ACAP impact organizational performance?	a. Quantitative study: OLS regression analysis on the impact of ACAP dimensions on performance (Article III) b. Qualitative study a large-scale interview study on dimensionality of ACAP (Article IV)	a. 135 companies in Estonia b. 62 interviews with companies in Estonia

Source: Composed by the author.

2.3 Measures and data collection

As this research focuses on the impact the knowledge sourcing strategies on organizational performance, measured through financial results, the main criterion for companies' selection in the samples was based on the company being a profit-seeking entity. Therefore, NGOs and state-owned companies delivering any sort of public good outside of the free market were not targeted in this research.

The data for analyses 1(a), 1(c) and 2(a) were derived from the Amadeus and Mergermarket databases and cover ICT companies operating in any country of the European Union (EU) as a main domicile. The focus on ICT was driven by the knowledge-intensity of this industry. The dataset included companies that possessed protected intellectual property in form of patents and, for 1(c) and 2(a), was further narrowed by companies' experience with corporate mergers, acquisitions or divestments during the period studied. The period was 2008-2017 in case of analysis 1(a) and 2008-2015 for analysis 2(a), resulting in a different sample size. The corporate combinations' dimension captures the external knowledge sourcing strategy, using three categories: *bidder* (company acquiring another company), *seller* (company divesting part of its operations or a subsidiary) and *target* (company becoming a subject of an acquisition transaction), to cover all dimensions of M&A activity. All three variables – *bidder*, *seller* and *target* – were coded as binary variables, representing a firm's exposure to the external knowledge sourcing. The contrasting dimension, or internal knowledge sourcing, was captured by the *R&D intensity* of the organization as well as its *patent* count increase for the period. These measures were numerical as reported by the companies. Also, several control variables were included, e.g. company *size*, *sector* and *country*.

The data for analyses 3(a) and 4(a) were obtained via a self-administrated survey targeting profit-seeking companies in Estonia. The surveys were answered by top management representatives or, in some cases, the owners – reflecting the fact that, in Estonia many business owners are actively involved in the daily management of the companies. The questions were based on earlier validated questionnaires focusing on ACAP (Flatten et al., 2011a; Flatten et al., 2011b; Jimenez-Barrionuevo et al., 2011; Noblet et al., 2011; Pavlou & El Sawy, 2011; Szulanski, 1996; Watkins & O'Neil, 2013). The final questionnaire consisted of 22 questions, with most questions utilizing a five-point Likert scale, with every element being targeted by several questions, allowing for validation and triangulation of the answers received. The main organizational performance indicator used for research question 4 (a) was financial performance or *profit*, cross-validated by intermediate performance indicators such as *innovation* and *market share*. Also, several control variables were included, e.g. company *size*, *industry*.

The data for analyses 1(b), 2(b), 3(b) and 4(b) were collected via semi-structured interviews with top managers and/or business owners of profit-seeking companies in Estonia, using a purposeful-sampling technique. The interview framework was extensively pre-tested and was based on the initial selection used for the questionnaire prepared for RQ1 as listed above, as well as capturing the suggested alterations to the ACAP model as suggested by the results obtained in 3(a). All interviews were conducted in person and lasted between 30 minutes and 1 hour and 30 minutes. The interviews were transcribed and coded for the purposes of further analysis.

The shift from an EU-wide, sector-specific sample to a single-country general sample was driven by a desire to capture more detail of the knowledge sourcing phenomena, addressing them in a more homogeneous macroeconomic environment, closer to the researchers. Losing the sector focus in an EU-wide dataset would result in massive dataset and potential sectoral or geographical peculiarities remaining uncaptured. Performing a combination of a quantitative and qualitative study in Estonia allowed the author to interpret the results in a familiar environment, making reasonable conclusions based on the results obtained.

2.4 Sample description

The data for this thesis comes from three samples as outlined in Table 1 above.

The data for questions 1(a) and 2(a) was extracted from the Amadeus and Mergermarket databases. The initial sample, used for 1(a), included 425 ICT companies operating in the EU as a main domicile that possess protected intellectual property in the form of patents. The period was shortened to 2008-2015 for 2(a) to avoid considerable loss of observations due to limited dataset data for 2016-2017; an additional dimension of the company's exposure to M&A activity was also added. The sample for 2(a) consisted of 123 ICT companies operating in EU as a main domicile. Both samples were skewed towards large companies and ICT services. For 2(a) 50% were large, 32% medium-sized and 11% were small-sized companies. The remaining 7% comprised microenterprises. ICT services contributed to 68% of the sample and the manufacturing of ICT equipment contributed 26%. The remainder was made up by ICT trade.

The sample utilized for the investigation of research questions 3(a) and 4(a) was obtained via a self-administrated survey targeting profit-seeking companies in Estonia. The sample included 135 companies with no particular focus area and was well balanced in terms of industry and company size. The industry breakdown was 20% wholesale and retail sale, 18% manufacturing and 13% construction. 27% of the sample was formed by microenterprises, with small companies representing 32% and medium-sized companies 23%. Large companies made up 18% of the sample.

The data for questions 1(b), 2(b), 3(b) and 4(b) were collected via interviews using a purposeful-sampling technique. The total case count amounted to 62 interviews with 61 companies, with two separate interviews with two separate respondents conducted in one large company. The inclusion of additional respondents per company was not considered necessary as the goal was to obtain the general perception of the management based on the corporate, rather than the individual, level. The sample was well balanced in terms of industry and company size. A total of 28% of companies in the sample were from the services industry, 21% were from manufacturing and 16% were from wholesale and retail sales. A total of 13% of the sample was made up of microenterprises, with small companies representing 26% and medium-sized companies 35%. Large companies made up 26% of the sample.

2.5 Data analysis

The interrelation between the internal and external knowledge creation practices (RQ1) was tested quantitatively through a series of *t*-tests (Article I) assuming unequal variances of populations' means. In addition, a qualitative investigation with the use of the data collected via semi-structured interviews was conducted (Article IV). Further, a large-scale longitudinal study, based on secondary database data (Article II) provided additional insight into the magnitude of the impact the strategies adopted over one another. The same study also focused on the strategies' benefits in terms of organizational performance, further enriched with some valuable insights collected from the analysis of the interview data (Article IV).

To test the earlier ACAP frameworks and, if needed, be able to propose a working model of ACAP (RQ3), a large quantitative study was undertaken to discover the dimensionality of the absorptive capacity phenomenon (Article III). Three methods were used to reveal the structure of ACAP: exploratory factor analysis (EFA) and multidimensional scaling (MDS) as frequentist analysis techniques and Bayesian dependency modelling (BDM) as an alternative method. While initially developing in the

same stream, the frequentist and Bayesian approaches have become seen as opposites (Zyphur & Oswald, 2013). While frequentist methods consider probability to be a share of the total population that possesses a certain property, the Bayesian approach estimates the probability of every individual observation having that property (Wylie et al., 2006).

Next, the model was further developed through an extensive qualitative interview-based study (Article IV). Qualitative studies involving multiple cases can smooth out inconsistencies and allow the discovery of patterns in a more robust manner (Yin, 2003). Data were thoroughly coded and both within-case and cross-case analyses were made, followed by a frequency analysis. The coding was two-fold: both theory- and data-driven. The analysis conducted revealed some unexpected findings, triggering additional and recurrent consultations with earlier literature (Silverman, 2000; Yin, 2003).

The impact of ACAP on organizational performance (RQ4) was studied based on the data originating from the same quantitative study and qualitative interview-based research, used for RQ3 (Articles III and IV).

The mixed method approach applied here throughout the RQs seeks to provide a more complete understanding on the matters investigated, cross-validating the results. A combination of different methods tackling the same research question provides a better insight into the phenomenon (Zyphur & Oswald, 2013).

3 Results

3.1 The interplay between the knowledge sourcing strategies

This findings for RQ1 revealed that external and internal knowledge search strategies are only somewhat related, not perfectly complementing one another.

In general, the results demonstrate that the companies actively engaged in external knowledge sourcing possess a considerably higher stock of internal knowledge – e.g. the average patent stock was 2 938.9 for companies that had completed acquisitions of other companies, as opposed to 39 patents for those that had not done so. Similar results were found in the case of companies with experience of divesting part of their own operations – 7 959.2 compared to 44.8. This suggests that a company's external knowledge sourcing activities, such as corporate combinations and divestments, help them generate a higher internal knowledge stock, which positions them more strongly vis-à-vis similar companies not engaging in such activities. However, a contrasting observation was registered with respect to the company itself becoming a target of corporate combination – it appears that organizations with a lower knowledge stock are favored by the acquirers, with significant accumulation of intellectual capital acting as a takeover protection. The average patent stock for companies who registered change in ownership over the period studied stood at 64.4, while those whose owner did not change possessed an average of 682.2 patents (more than 10 times more).

Similarly, the companies with a higher internal knowledge stock were more open to external knowledge sourcing. The difference was especially marked for corporate divestment activity, where the companies selling off part of their business seemed to have a considerably higher level of internal knowledge – the probability of divesting was 0.118 for companies with an above-average internal knowledge stock compared to 0.015 for their below-average counterparts. A similar tendency was found in the case of probability to acquire: companies with a higher knowledge stock were more likely to acquire (0.208) compared to companies with a lower knowledge stock (0.167). Again, a contrasting observation was registered for change in ownership – companies with a higher knowledge stock were less likely to be targeted for corporate acquisition (0.136 compared to 0.181 for similar companies with a lower knowledge stock).

This demonstrates that, although external knowledge sourcing measured through corporate acquisitions and divestments behave similarly and do seem to complement internal knowledge sourcing, becoming a target of a corporate combination transaction undermines complementarity. Instead, strong internal knowledge sourcing acts as a robust takeover protection mechanism.

The qualitative interview-based study, not limited by particular measures of internal and external knowledge development, revealed more links between the two strategies (Article IV). The most widely mentioned practice of external knowledge sourcing involved benchmarking – mostly at a regional or even global level – through which companies would closely follow the developments of their distant competitors, copying their decisions and products in their own geography and setting. Having a role model from a relatively more developed market, these companies tried to get ahead of local competition. At the same time, this also required the copied solutions to be adapted to the local setting, so the organizations blended the knowledge sourced externally with their existing stock of internal knowledge. Such practices would suggest that external knowledge sourcing acts as an important input to internal knowledge development. No reverse tendency was mentioned by the companies. They did not engage in specific

external knowledge sourcing activities, building mainly on their internal strengths. Thus, the complementarity suggested by this study was one-directional, with external knowledge sourcing strategy adding to the internal knowledge sourcing. However, as the general rule, the companies pointed out that they did not intentionally focus on only one knowledge sourcing strategy, but rather tried to diversify the prospects, sourcing new ideas and knowledge both internally as well as externally.

The following quantitative study (Article II) measured the precise impact that the two knowledge sourcing strategies had on one another. Internal knowledge sourcing was proxied by R&D intensity and an increase in the patent count possessed by the company. External knowledge sourcing was measured using three dimensions of corporate combinations: acquisition of another company, becoming a takeover target and divesting of a business unit or subsidiary. As these measures have often been used to capture the same concepts, it was expected that their performance would be similar. However, while the general co-movements advocated in Articles I and IV were largely positive, the numerical validation provided by Article II demonstrated certain peculiarities.

External knowledge search practices demonstrated a consistently positive, although marginal ($\beta<0.122$), impact on patent accumulation. At the same time, they persistently discouraged internal R&D effort ($-0.310<\beta<-0.005$). The impact of internal knowledge sourcing dimensions on external knowledge sourcing was mixed. While R&D was inferior to sourcing through corporate acquisitions or divestments, it made the company more likely to become a target of an acquisition ($0.027<\beta<0.070$). The increase in the patent count, on the contrary, made it more likely that an organization would divest its business units and/or subsidiaries ($0.121<\beta<0.142$), while discouraging a change in ownership and reporting mixed results on acquiring another companies.

Thus, the overall conclusion is that the debate around the complementarity of knowledge sourcing strategies is justified. Although there is an overall positive co-movement, the role of external knowledge sourcing for internal development is more obvious and straightforward than the reverse relationship.

3.2 The relative impact of knowledge sourcing strategies on performance

The assessment of the impact that internal and external knowledge sourcing strategies have on organizational performance (RQ2) revealed somewhat inconsistent and surprising results (Article II).

The general assumption regarding the benefits provided by both strategies did not hold true. Internal knowledge sourcing demonstrated a negative impact on most performance indicators ($-0.270<\beta<0.008$). This influence is confusing. While R&D or costs related to the registration of new patents are indeed a cost, affecting short-term profitability negatively, this should result in an increase in performance in the longer run. The eight-year period investigated should have balanced out the temporal effects, which was not the case for the dataset studied.

External knowledge sourcing demonstrated mixed results, with only a registered change in ownership mostly improving performance ($-0.015<\beta<0.049$). The other two subsets – acquiring a company or divesting a business unit or a subsidiary – showed a largely negative results across the performance indicators studied ($-0.036<\beta<0.054$ and $-0.018<\beta<0.038$, respectively). At the same time, the magnitude of the impact of the latter two dimensions was smaller than that of internal knowledge sourcing, suggesting that external knowledge sourcing is less performance-deteriorating compared to internal sourcing. The evidence for this part of RQ2 is, however, inconclusive.

3.3 The ACAP model

The first stage of the ACAP model testing, a quantitative study (Article III), did not provide evidence for the existing models that were used as a basis for it (Cohen & Levinthal, 1990; Zahra & George, 2002). Instead, it revealed a four-dimensional construct of ACAP, with dimensions simultaneously co-shaping the phenomenon, rather than creating it in a step-wise manner (Figure 4).

The first dimension, *continuing development*, stresses the need for rapid organizational re-shaping, i.e. the resources used or products/services offered. It unites all aspects related to organizational development: employees' learning, the importance of new trends for strategy, the development of new products/services, improvements to internal processes and technological solutions, striving for new ways to apply existing solutions. The *bottom-up innovation* dimension signifies that the ideas for organizational development should be sourced from all levels of the hierarchy. It encompasses employees' ability to recognize the value of new trends, their willingness to generate new ideas and opportunities to apply those ideas in real life. *Trust-based internal cooperation* outlines the need for joint efforts within a company – signifying the need for effective ways to exchange information as well as the importance of cooperation and trust among team members. Finally, *deferred knowledge use* emphasizes the need for suitable routines to retrieve knowledge created earlier. It focuses on the codification of valuable knowledge, allowing for its later recovery and application.

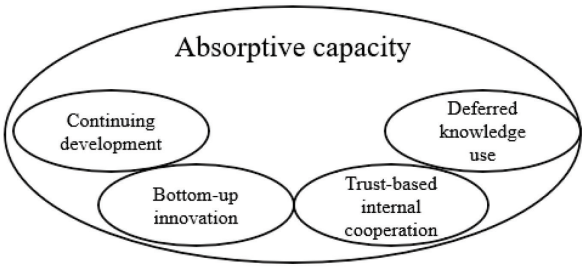

Figure 4. *Proposed ACAP model.*
Source: Article III (Stulova & Rungi, 2017).

The next stage of the research, a large-scale, interview-based study, generally confirmed the proposed dimensionality of ACAP, as well as provided further details (Article IV). It also revealed a certain hierarchy between the dimensions, with *continuing development* being the main focus of businesses. Organizations do have a positive attitude towards the intake of new information, sourced internally or externally. They closely follow market developments and the moves of their competitors, sometimes going as far as imitation. Interestingly, benchmarking is mostly global – organizations feel that they are well-distinguished in the local market, absorbing new ideas mainly from other geographies or business areas. They also emphasized a focus on understanding the existing demands of existing clients and no tendency for, for instance, disruptive product innovation that would precede client demands.

The overall developments pursued by the companies studied were mainly focused on process improvements, not product innovation. Ideas were indeed encouraged at all levels of hierarchy, although most of the *bottom-up innovation* was focused on internal work processes, not business development. It was also discovered that employee initiative

is mostly not rewarded, resulting therefore from self-motivation. Although hierarchies within organizations are becoming flatter, the decision-making seems to still be rather centralized, and ideas need to be approved at the very top to be realized.

Also, it has been pointed out that employees are mainly expected to act as a channel to transfer clients' needs and desires to the management of organization. *Trust-based internal cooperation* was considered to be an inherent part of organization functioning, especially given the mostly prevailing flat hierarchies – and is seen as an important determinant of any result within the organization.

Deferred knowledge use was mostly disregarded by the companies studied: there were no actual routines for knowledge codification that would allow the subsequent retrieval of data. Instead, most of the ideas that were not immediately implemented remained with the teams, increasing the role of individuals in the organization's success. Many companies tended to interpret this subset narrowly, focusing on the retention of accounting, product or client data as prescribed by the law. This result could also be a consequence of increasing environmental turbulence –knowledge becomes obsolete fast, or the companies are cherry-picking the most valuable knowledge to retain, forgetting the rest.

In summary, the findings for RQ3 suggest that the prevailing ACAP models are not fitted to the setting investigated. A new success-factor based model comprising four elements is proposed, capturing the dynamism of the ACAP phenomenon.

3.4 The impact of ACAP on organizational performance

The influence of ACAP on organizational performance (RQ4) was studied at the level of its dimensions uncovered revealed in RQ3, providing further understanding of the phenomenon (Article III). The research model is summarized in Figure 5.

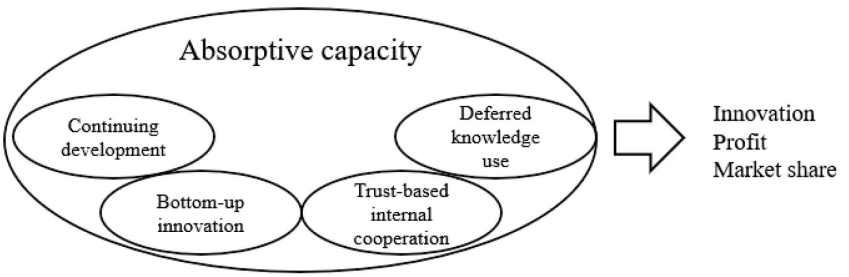

Figure 5. *Research model: the impact of ACAP on organizational performance.*
Source: Article III (Stulova & Rungi, 2017).

The major positive influence stemmed from the *continuing development* subset, which had a persistently positive and strong impact ($0.468<\beta<1.198$). The other elements demonstrated a rather negative influence, although of a smaller magnitude. *Bottom-up innovation* demonstrated a slight negative impact ($-0.565<\beta<-0.226$), compromising the role of employee initiative. *Trust-based internal cooperation* showed mixed results and *deferred knowledge use* was mostly value-deteriorating ($-0.148<\beta<0.238$). The opposite movements of *continuing development* and *deferred knowledge use* might suggest that these dimensions are meant to fulfill different goals – one is growth-related, while the other focuses on stability. Depending on the development cycles, these could be counterbalancing the course of organizational development, exactly as shown by this

study – while *continuing development* added to organizational performance, *deferred knowledge use* was mostly inferior for the period under investigation ($-0.503<\beta<0.309$).

The qualitative part of the study suggests that internal dimensions such as *bottom-up innovation* and *trust-based internal cooperation* were focused on internal development, and were little used for commercial goals (Article IV). Surprisingly, the results demonstrated the prevalence of a rather top-down idea-generation approach, with employees seen mostly as a channel to transmit client preferences, without generating ideas based on this data. The *deferred knowledge use* subset was mainly interpreted narrowly (e.g. retaining documentation) and did not receive much appreciation by firms. Seemingly, the companies were not interested in the codification of existing knowledge, exposing themselves to the risk that most of it remained in employees' heads. At the same time, all forms of *continuing development* were receiving considerable attention within the companies. The companies were striving to grow persistently, monitoring market trends and benchmarking themselves against others – especially internationally, seeking considerable commercial benefits and potential performance improvement.

Summing up the findings for RQ4, the research concludes that continuing development subset positively impacts organizational performance, while mostly disregarded *deferred knowledge use* was value-deteriorating. The other elements of ACAP showed inconsistent results.

4 Discussion

This thesis focuses on the relative benefits of internal and external knowledge sourcing strategies, while also providing a validation of the mechanism underpinning the ACAP phenomenon and its impact on organizational performance. The findings are summarized in Table 2 and discussed further below.

Table 2. *Research questions and results*

	RQ	**Result**
1	How are internal and external knowledge sourcing strategies related?	Only limited complementarity observed.
2	How much do the internal and external elements of knowledge sourcing impact organizational performance?	Internal knowledge sourcing is value-deteriorating. External knowledge sourcing reports mixed results.
3	If the original model of ACAP needs further development, what framework could be proposed?	This study did not validate the existing models. A new framework comprising four simultaneously existing elements is proposed: continuing development, bottom-up innovation, trust-based internal cooperation, deferred knowledge use.
4	How much does ACAP impact organizational performance?	Considerable positive impact of continuing development subset, which also receives most attention by organizations. Negative impact of bottom-up innovation and deferred knowledge use.

Source: Composed by the author.

An investigation of the interplay between the knowledge sourcing strategies demonstrates that, while there is a certain complementarity between internal and external knowledge sourcing strategies, these are not too close.

In the quantitative part of the study, three M&A activity dimensions were used as a proxy for external knowledge sourcing: acquisition of another company, becoming acquired or selling a business unit or subsidiary. While the first two proxies are seemingly similar in the way that they involve a combination of two knowledge bases – the one of the acquirer and the one of the target company (Ahuja & Katila, 2001) – they actually behave very differently. Acquiring a company and divesting of a business unit as external knowledge sourcing strategies do act similarly to internal knowledge sourcing (R&D and patent development), supporting the complementarity of the strategies as advocated by Sahaym et al. (2010) and Benson and Ziedonis (2009). This complementarity among the discovered dimensions further strengthens the arguments of Zacharia et al. (2011) and Posen and Chen (2013), who asserted that, in order to be able to successfully source external knowledge, an organization has to have strong internal knowledge sourcing. The qualitative part of the research demonstrated that less invasive processes of external knowledge sourcing are applied by companies to a large extent, with benchmarking

against distant peers in larger or more developed economies being the main tactic. Although not deliberately favouring either knowledge sourcing strategy, organizations seem to build up on internal knowledge, complementing it with external knowledge sourcing. Thus, a certain complementarity of the knowledge sourcing dimensions can be concluded, but the differences demonstrated make it far from being a close similarity.

At the same time, a very distinct pattern was observed in the case of a company becoming a target of an acquisition transaction, contradicting the general assumption regarding the benefits of the knowledge bases' pooling following the transaction – the results suggest that the acquirer mostly wishes to take over companies with lower existing internal knowledge and higher growth potential. This suggests that some dimensions of the knowledge sourcing strategies are highly distinct, in line with Bertrand and Mol (2013) and potentially even supporting the argument of substitutivity proposed by Lichtenthaler (2016).

A more precise quantitative investigation of the magnitude of the impact that the two have on one another reveals a confusing causal relationship between the two strategies, with certain elements within one strategy behaving differently. External knowledge sourcing adds to patent accumulation, while discouraging R&D effort – even though patents and R&D are often considered to be two facets of the same internal knowledge sourcing strategy. This could signify a curvilinear relationship, not captured in this research (Rothaermel & Alexandre, 2009) or prove that the strategies address different needs of the companies, perhaps not captured herein (Sahaym et al., 2010). In contrast, R&D contributes to the probability of the company being acquired by other entity, while patent accumulation discourages it.

The results could also be a function of the synergies between the knowledge sourcing strategies (Monteiro et al., 2017), with various sub-elements of the strategies supporting or contributing to one another, without affecting the overall movements of the strategy. In this context, Swift (2016) stressed that the emphasis of the knowledge sourcing strategy might be shifting over time, based on corporate needs – with some periods favoring internal knowledge, and others – external.

The research also confirms the organizations' desire to be open both to internal and external knowledge sourcing, attempting to combine the ideas and knowledge arising. This corresponds to the earlier literature, which has also suggested balancing between the two (Ben-Oz & Greve, 2015; Zollo et al., 2002).

In summary, the findings for RQ1 reveal patterns in the relationship between the two strategies. Internal and external knowledge search strategies are not perfectly complementary, but they do support one another to a certain extent. The strategies are clearly not opposites, rejecting the hypothesis proposed by Bertrand and Mol (2013). While internal sourcing has been demonstrated to be an antecedent to external knowledge sourcing in earlier research (Posen & Chen, 2013; Zacharia et al., 2011), the reverse relationship is seen to prevail in this study. Instead of favouring one over another, organizations opt for combining both strategies (Martin-de Castro, 2015).

Earlier research has suggested that both internal and external knowledge sourcing strategies are value-adding (Weigelt & Sarkar, 2012). The results of the current study, however, do not fully support this argument, even somewhat compromising the general premise regarding the benefits of learning (Tsai, 2001) as internal knowledge sourcing reports persistently negative results and the impact of external sourcing is inconsistent.

Internal knowledge sourcing strategy shows an inferior impact on performance indicators, stronger in the case of R&D intensity. External knowledge sourcing strategy demonstrates marginal results of inconsistent direction of impact. Comparing the impact

that internal and external knowledge sourcing strategies have on organizational performance, only limited conclusions can be drawn. The study reveals that both strategies can affect organizational performance negatively. As the negative impact of internal knowledge sourcing is persistent, while external knowledge sourcing shows mixed results, the relative benefit comparison is in favour of external knowledge sourcing. This contradicts Carlo et al. (2012) and Swift (2016), who posited that internal knowledge sourcing allows resources to be better directed (leading to more benefits), but supports Liu et al. (2019) and Benson and Ziedonis (2009), who proposed that external knowledge sourcing is more beneficial. It might also provide limited confirmation for Knott (2008), who proposed an inverse relationship between knowledge strategies and performance, as well as contradicts Carlo et al. (2012), who advocated path-dependency.

The findings for RQ2 to a certain extent question the overall acceptance of the benefits of knowledge accumulation (Tsai, 2001). Internal knowledge sourcing is value-deteriorating, while external sourcing strategy shows mixed results. Interpreted narrowly, one can conclude that external knowledge sourcing is more beneficial. However, in the most extreme case, it could provide evidence in favour of the view that knowledge has negative effects (Hitt et al., 1991; Kumar, 2009). Previous research has not provided any evidence for the potentially negative influence of knowledge sourcing. Most of the works have demonstrated the benefits of knowledge sourcing (Carlo et al., 2012; Monteiro et al., 2017), while others have suggested the prevalence of external knowledge sourcing, somewhat shown also in the current research (Benson & Ziedonis, 2009; Liu et al., 2019).

This thesis proposes an extension to the ACAP model, symbolizing a shift from a sequence of steps that articulate knowledge within an organization, to a set of elements, existing simultaneously and supporting one another. These elements are the *continuing development* orientation of the organization, the *bottom-up innovation* effort of employees, the *trust-based internal cooperation* within the organization and its capacity for *deferred knowledge use*. Although contradicting the prevailing premise regarding the step-wise nature of the concept (Cohen & Levinthal, 1989, 1990; Zahra & George, 2002), the proposed simultaneous co-existence is in line with earlier thoughts of Sun and Anderson (2010), Flatten et al. (2011b) and Marabelli and Newell (2014), who suggested that the relationship between the elements might be non-linear and more complex. The elements of the model are not revolutionary either – some resemble the proposals made in earlier works on knowledge practices (Garcia-Morales et al., 2011; Tippmann et al., 2013). However, the combination of factors, developed empirically in this research, is novel. The shift from sequential dependency, present in earlier models, to a simultaneous combination of elements, might be a result of increasing environmental turbulence (Menon et al., 2002).

Although pioneers of the concept, Cohen and Levinthal (1989, 1990) have positioned ACAP as a capability, embedded within organization, rather than the individuals linked to it, the model presented in this study suggests a strong link to the people working inside the organization. Employees are an inherent part of *bottom-up innovation* and *trust-based internal cooperation* dimensions, as well as being involved in the *continuing development* and *deferred knowledge use* subsets. This link to the human element draws the model closer to the organizational learning theory, which stresses the central role of the individual in organizational advancement (Pedler et al., 1991). The evolution and importance of *bottom-up innovation* and *trust-based internal cooperation* relates also to the fact that organizations try to balance between the two knowledge sourcing strategies (Murovec & Prodan, 2009). It also signifies a shift towards a transformational management style by organizations (Bryant, 2003) and the role of people within organization in companies

remaining competitive (Garcia-Morales et al., 2011). The simultaneous existence of *continuing development* and *deferred knowledge use* concepts is at first glance somewhat confusing as one encourages dynamism, while the other suggests turning to the knowledge generated earlier. Rapid changes in the products made and the technologies used (Bettis & Hitt, 1995), on one hand, promote only development orientation. At the same time, however, it is generally agreed that learning is cumulative and path-dependent (Kim & Inkpen, 2005; Lane et al., 2006), although a conflicting view on the importance of organizational forgetting has also emerged in earlier literature (Holan & Phillips, 2004).

Further examination of the proposed framework suggests that, while the elements exist simultaneously, *continuing development* is the element on which organizations focus the most. Organizations confirm their constant search for a competitive advantage (Barney, 1991). A strong client focus has been uncovered, meaning that organizations try to capture the existing demands of their clients, rather than developing a revolutionary product that customers do not know they want (Keeley et al., 2013). This leads to a suggestion that the development is mainly a function of overall market movements, i.e. the companies are adapting to the business environment, not shaping it (Wang & Ahmed, 2007).The emphasis on employees, advocated by the model and represented in two dimensions – *bottom-up innovation* and *trust-based internal cooperation* – creates a bridge between ACAP and the learning organization metaphor (Pedler et al., 1991), where intentional learning at an individual level is central to organizational development. It also links the ACAP theory to organizational learning (Sun & Anderson, 2010). The behaviour in relation to the *deferred knowledge use* element demonstrates the tendency to view organizational forgetting as important (Cepeda-Carrion et al., 2012; Holan & Phillips, 2004).

The findings for RQ3 are conclusive: prevailing models of ACAP are not fitted for the setting investigated. A new, success-factor based framework for ACAP is, therefore, proposed. The phenomenon is composed of *continuing development*, *bottom-up innovation*, *trust-based internal cooperation* and *deferred knowledge use* subsets. Although these subsets work simultaneously, there is a certain hierarchy within them, with organizations mainly focusing on continuing development and disregarding other elements, especially the deferred knowledge use element.

Assessment of the impact that these elements have on organizational performance demonstrates that the most value-adding subset, resulting in improved financial results, is *continuing development*. This is in line with the view that organizations have to be on top of market developments in order to remain competitive (Coombs & Bierly, 2006). An observed pattern of recurrent benchmarking goes as far as imitation, with companies trying to copy the best innovators, mostly on a regional/global level (DiMaggio & Powell, 1983). The *bottom-up innovation* is shown to be focused on internal process improvements, while being inferior to financial performance. This inferiority might be a result of weak middle management not being able to create a favourable environment for the transfer of ideas (Burgelman, 1983) or a lack of freedom within organizations (McGrath, 2001). The top management might be concerned about potential idea flow from lower levels of hierarchy, as too many ideas might also distort business focus (Zhao & Chadwick, 2013) or it could also be a sign of low team autonomy, especially given the mixed impact of the *trust-based internal cooperation* dimension (Amabile, 1998). Teamwork is a proven mean for boosting innovation in turbulent times (Biedenbach & Müller, 2012), so the mixed effect could be a by-product of the period studied. The *trust-based internal cooperation* dimension is perceived as an integral part of operations, having little influence on the overall result, in line with the notion of

knowledge workers, which is central, for example, to information transfer (Drucker, 1967). Social interactions across actors within organizations have also been previously demonstrated to improve understanding of business needs, stimulating the generation of new ideas (Jansen et al., 2005). The *deferred knowledge use* element shows a negative impact on performance, signifying the dynamism of the business terrain, where knowledge and ideas change quickly. Even though the general understanding is that knowledge is cumulative (Bierly et al., 2009), the complexity of the business terrain also means that knowledge becomes obsolete quickly (Hedberg, 1981). However, the positive influence of *continuing development* is of a considerably higher magnitude, linking this research to such positivise views referred to earlier (George et al., 2001; Rothaermel & Alexandre, 2009).

The findings for RQ4 suggest that the continuing development subset benefits organizational performance the most, while bottom-up innovation and deferred knowledge use are inferior. It must also be acknowledged that these elements pursue different goals, with the main efforts of bottom-up innovation being directed towards internal process improvements.

5 Conclusion

The aim of this doctoral thesis was to address the research gaps identified in earlier studies on knowledge sourcing. The thesis has investigated the knowledge sourcing strategies applied by companies, assessing the impact that internal and external knowledge sourcing have on organizational performance, thus and revealing superior strategies. It has also investigated the mechanisms underpinning the ACAP phenomenon and has assessed their impact on organizational performance.

This thesis reveals that, although being partially complementary, internal and external knowledge sourcing strategies are not perfectly interchangeable. More specifically, while patenting and R&D are both elements of internal knowledge creation, only patenting adds to external knowledge search, with R&D being inferior. Two subsets of external knowledge search – taking over a company and divesting one – act similarly in relation to internal knowledge search. Meanwhile, corporate acquisitions mainly benefit the acquirer, while a higher stock of internal knowledge in the form of patents acts as a strong protection against takeover. Although these findings do not provide explicit evidence in favor of the strategies' complementarity (Sahaym et al., 2010) or their non-complementarity (Bertrand & Mol, 2013), the results contribute to the view expressed earlier that companies strive to combine both knowledge strategies (Martin-de Castro, 2015).

Interestingly, neither internal nor external knowledge sourcing strategies proved to provide any solid advantage or create superior returns, although a stronger negative influence was found to stem from internal knowledge sourcing strategy. These findings add to the literature on the interplay between internal and external knowledge sourcing, providing limited confirmation for the propositions of Benson and Ziedonis (2009), Posen and Chen (2013), Sahaym et al. (2010) and Zacharia et al. (2011). The findings also provide support for the arguments of Bertrand and Mol (2013) regarding the non-complementarity of the strategies, relating to their substitutivity, as advocated by Lichtenthaler (2016). The shown negative impact on performance, however, undermines the general belief regarding the value added by knowledge creation and learning (Tsai, 2001), somewhat supporting Hitt et al. (1991) and Kumar (2009).

The results are coherent with organizations' expected desire to find a balance between internal and external knowledge sourcing, not limiting themselves to only one strategy, which has been advocated in earlier research (Ben-Oz & Greve, 2015; Zollo et al., 2002). This thesis demonstrates that organizations are open to both knowledge sourcing strategies, although they mainly focus on internal developments, using external knowledge sourcing mainly in the form of benchmarking against competitors.

The thesis also expands the literature on ACAP, providing new knowledge on how the phenomenon works, as well as validating the main relationships within the model. The main result is a suggested extension of the ACAP model, signifying a shift from a sequential process to a combination of elements, working simultaneously. The elements are continuing development, bottom-up innovation, trust-based internal cooperation and deferred knowledge use. The dimensionality emphasizes an increasing role of individuals – two out of the four dimensions are founded on the people in an organization. This establishes a strong link to the learning organization theory (Pedler et al., 1991).

This suggested extension of the model is in line with the calls for model development expressed in numerous earlier studies (Maldonado et al., 2019; Todorova & Durisin, 2007; Volberda et al., 2010). Although the dominant models of ACAP, proposed by Cohen and Levinthal (1989, 1990) and Zahra and George (2002) are sequential, the alteration proposed in this work is not so novel. The agility suggested by the extension proposed

supports the dynamism advocated by Sun and Anderson (2010) and the non-linearity highlighted by Marabelli and Newell (2014).

While the elements of the proposed model of ACAP co-exist and are interdependent, there is a certain hierarchy within them, with the continuing development subset gaining most attention among the organizations, as well as adding to organizational performance the most. While earlier research has suggested the positive influence of ACAP, irrespective of its dimensionality (Maldonado et al., 2019), this work provides evidence that the positive impact stems from the continuing development element, with other elements being inferior or exercising a marginal impact of inconsistent direction. Moreover, the proposed bottom-up innovation dimension of ACAP targets internal process efficiencies instead of organizational performance. The extremely limited application of the deferred knowledge use subset and its negative impact on performance signifies the role of organizational forgetting for organizations (Cepeda-Carrion et al., 2012), confirming that knowledge becomes obsolete quickly (Hedberg, 1981).

Practical implications

This thesis provides practical guidance for organizations in formulating their knowledge sourcing strategy.

First, it concludes that, although there is a certain complementarity between internal and external knowledge sourcing, it is not perfect. While some of the elements correlate, others demonstrate negative influences. Second, it demonstrates that there is no unique superior knowledge sourcing strategy to achieve superior results. Engagement in either internal or external knowledge sourcing does not automatically improve results or any other dimension; both need to be developed separately, as they are targeting different organizational needs and complement one another in a limited manner. Even though both knowledge sourcing strategies can be performance-deteriorating, the external strategy provides less distortion, i.e. potentially suggesting that it could be a more preferable choice. The most advantageous strategy is a combination of both strategies. Third, the thesis describes the elements that organizations should focus on to be able to create ACAP, a capacity needed to make use of new knowledge, sourced internally or externally. Effective ACAP includes continuing development orientation, bottom-up innovation, trust-based internal cooperation and deferred knowledge use. Finally, out of all the subsets of ACAP, organizations should most vigorously cultivate the continuing development dimension – investing in employees, processes, product development. This is what most organizations that were investigated are doing and this is where most of the performance enhancement comes from. Therefore, to maximize performance, companies should engage in continuing development, enhancing their products and services, as well as searching for new opportunities. Internal process development can be sourced from within the organization, utilizing the bottom-up innovation element of ACAP.

Overall, the results suggest that the companies do not focus exclusively on one knowledge creation strategy, but rather utilize both options and develop them independently of one another. This is in line with earlier literature suggesting balancing between the options, increasing potential benefits.

Limitations and future research

The study utilized three datasets: large-scale panel data on European ICT companies; a quantitative set of survey data and large-scale interview data on Estonian profit-seeking companies. The results are not generalizable to non-profit oriented organizations, such as

governmental institutions, universities, trade unions etc. Also, they might be sector- or economy-specific, limiting generalizability. Thus, further research, validating the results obtained herein, especially in different geographies and/or involving other sectors of the economy, is encouraged.

The new suggested model of ACAP does not specifically differentiate between potential and realized ACAP, undermining the results. Inclusion of these subsets in future research could unlock additional insights into the phenomena studied.

Also, as the proposed development of the ACAP model includes a strong emphasis on the employees, an integration of several units of analysis would be beneficial as a further research avenue, encompassing the role of the individual for knowledge sourcing. Similarly, more variables could be included, potentially capturing other influences on the dimensions of knowledge sourcing. Other research methods could be used, potentially capturing the patterns of strategy combination that companies might be using (Monteiro et al., 2017) or the curvilinearity of the impact on performance suggested earlier (Rothaermel & Alexandre, 2009). As knowledge sourcing is concerned with the changes occurring in the surrounding environment, the inclusion of measures capturing environmental changes can provide additional insight into the patterns around the phenomena investigated. Similarly, more characteristics of the organizations studied could be included. In particular, the development phase of the company might have a considerable effect on its development patterns and openness towards new knowledge.

Methodological choices applied for this research also entail certain limitations. The utilization of other analytical frameworks and methods could potentially provide different results and is strongly encouraged in future research.

There were also certain inconsistencies within the various measures for the same dimension investigated. Specifically, while R&D was almost always value-deteriorating, patent count increase was shown to have a positive and statistically significant impact on organizational performance – potentially signifying that the measures used have certain differences that were unaccounted for. Similarly, joint investigation of three subdimensions of M&A – acquiring another company, selling part of business, or being acquired – might be too excessive to be included into one study, undermining the overall results. Thus, a separate investigation of the variables used herein, as well as the inclusion of other measures are encouraged as future research avenues.

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Abstract
Knowledge sourcing strategies and their impact on organizational performance

This thesis focuses on the knowledge sourcing strategies implemented by organizations in their search for long-term competitiveness. The role of knowledge in corporate survival cannot be understated (Grant, 2013; Nonaka, 1994). The knowledge-based view, used as the main framework theory, posits that new knowledge originates either from efforts internal to an organization or is sourced from outside (Eisenhardt & Santos, 2002; Un, 2017). By investigating the interplay between internal and external knowledge sourcing and assessing the relative impact that these strategies have on organizational performance, this paper attempts to reveal the most beneficial strategy. Next, it proceeds to propose a validation of the existing ACAP models and appraises the benefits that this capacity entails for organizational performance.

Implementing a mixed-method methodology, this thesis seeks to obtain a full picture of the relative benefits of knowledge sourcing and the processes behind the ACAP phenomenon. The analytical part uses data on three different populations, with two representing profit-seeking companies in Estonia, without any particular sector focus, and the third being based on ICT companies operating within the European Union.

The thesis confirms the non-complementarity of internal and external knowledge sourcing strategies, suggesting that the two have separate ways to impact performance as well as they enhance one another in an extremely limited manner (Article I). While external knowledge search practices do indeed also contribute to internal knowledge development, the reverse relationship was not demonstrated in this study. Comparing the effect that the two knowledge sourcing strategies have on organizational performance, no significant benefits were reported. While internal knowledge sourcing demonstrated a negative impact, external knowledge strategy showed mixed results (Article II).

Next, the thesis proposes a modification to the ACAP model, suggesting that the phenomenon is a set of success factors, existing simultaneously, rather than a sequence of steps (Article III). The elements include continuing development, bottom-up innovation, trust-based internal cooperation and deferred knowledge use. Despite existing and contributing simultaneously, there is a certain hierarchy. The continuing development facet receives most attention among firms and is also demonstrated to have the strongest positive impact on the financial results. The bottom-up innovation focuses more on internal process improvements and does not contribute to organizational performance (Articles III and IV).

The results provide additional insight into the research gaps highlighted in earlier studies on knowledge sourcing strategies, based on which practical recommendations for decision-makers are offered. Investigation of the potential complementarity and the benefits of the two knowledge sourcing strategies, as well as a deeper examination of the mechanism underpinning ACAP, improve awareness related to knowledge management, as well as provide valuable implications for organizations in developing their knowledge sourcing strategies.

Lühikokkuvõte
Teadmiste hankimise strateegiad ja nende mõju organisatsiooni tulemustele

Käesoleva doktoritöö keskseks teemaks on teadmiste hankimise strateegiad organisatsioonides. Tänapäevases kiiresti muutuvas ärikeskkonnas on teadmistel keskne roll ettevõtte edu kujundamisel, teadmised aitavad kaasa pikaajalisele konkurentsivõimele (Nonaka, 1994; Grant, 2013). Teadmistepõhine teooria, mis raamib antud doktoritöö uuringut, selgitab, et uued teadmised tulevad kas ettevõtte sisemiste jõupingutuste tulemusena või neid otsitakse väljast (Eisenhardt and Santos, 2002; Un, 2017). Uurides sisemise ning välise teadmiste hankimise strateegiate vastastikke mõjusid ning võrreldes nende mõjusid organisatsiooni tulemustele, võtab antud uuring eesmärgiks selgitada välja kõige kasulikuma strateegia. Lisaks valideerib antud uuring senised õppimisvõime mudeleid ning õppimisvõime kui organisatsioonilise võimekuse mõju organisatsioonilistele tulemustele.

Kasutades erinevaid analüütilisi meetodeid, püüab doktoritöö saada võimalikult laia pildi teadmiste hankimise strateegiate kasulikkuse kohta, selgitades välja ka protsessid õppimisvõime taga. Töö analüütiline osa kasutab kolme erinevat andmestikku: kaks baseeruvad Eestis tegutsevate kasumit taotlevate ettevõtete valimil ilma valdkonna fookuseta, ning kolmas kasutab Euroopa Liidus tegutsevate info- ja kommunikatsioonitehnoloogia ettevõtete valimit.

Doktoritöö kinnitab teadmiste hankimise strateegiate vastastikku mitte-täiendavust, ehk sisemine ning välimine teadmiste hankimise strateegia omavad eraldiseisvat mõju ning tugevdavad üksteist vaid piiratud ulatuses (Artikkel 1). Kui väline teadmiste hankimine tugevdab sisemist hanget, siis vastassuunaline trend ei leidnud siinkohal tõestust. Võrreldes kahe strateegia mõjusid organisatsiooni tulemustele, ei leidnud töö märkimisväärset mõju. Kui sisemine teadmiste hange mõjutab organisatsioonilisi tulemusi negatiivselt, siis väline hange mõju on ebaselge (Artikkel 2).

Lisaks pakub see doktoritöö õppimisvõime mudeli modifikatsiooni, mille moodustavad neli samaaegselt töötavat elementi ning mitte järkjärguline protsess, nagu arvati varasemates mudelites (Artikkel 3). Uue mudeli elemendid on pidev areng, alt-üles innovatsioon, usalduspõhine koostöö ning teadmiste säilitamine. Kuigi need elemendid töötavad ning aitavad orgisatsiooni arengule kaasa samaaegselt, eksisteerib nende vahel teatud hierarhia. Pideva arengu dimensioon pälvib ettevõtete suurima tähelepanu ning aitab organisatsiooni tulemustele kaasa kõige enam. Samal ajal usalduspõhine koostöö peamiseks väljundiks on sisemiste protsesside optimeerimine ning see ei aita tulemustele kaasa (Artiklid 3 ja 4).

Doktoritöö tulemused loovad lisandväärtust teadmiste hankimise strateegiate teemadel, käsitledes varasemates uuringutes avastatud uurimislünkasid. Lisaks pakub see töö praktilist nõuannet otsustajatele, kes tegelevad teadmiste hankimisega organisatsioonides. Leiud teadmiste hankimise strateegiate potentsiaalsest koosmõjust, strateegiate kasulikkusest ja ka sügavam pilk õppimisvõime protsesside taha tugevdab senist teavet teadmiste juhtimisest ning pakub väärtuslikku sissevaadet organisatsioonidele.

Appendix

Publication I

Kiisk, V. (2019). The interplay between knowledge creation strategies: The case of European information-and-communications-technology firms. The IEEE International Conference on Engineering and Engineering Management (IEEM), Macao, China, 15-19 Dec 2019. (ETIS 3.1.)

The Interplay Between Knowledge Creation Strategies: The Case of European Information-and-Communications-Technology Firms

V. Kiisk[1]
[1]Department of Business Administration, TalTech, Tallinn, Estonia
valeria.kiisk@gmail.com

Abstract – **This paper explores the interplay between two dimensions of organizational learning – internal knowledge creation and external knowledge sourcing. Based on a sample of European information-and-communications-technology firms, this research demonstrates that there are differences in behavior as well as co-movement between the dimensions. The companies engaged in external learning tend to possess more internal knowledge stock as well as that higher internal knowledge stock triggers more active external learning strategies through business combinations, especially divestments.**

Keywords – **organizational learning, patents, M&A**

I. INTRODUCTION

The companies are heavily influenced by the business environment they operate in [11]. Fast pace of external changes poses constant challenges and the ability of firms to capture the changes arising as well as to benefit from them is often triggered by the learning processes within the organization [20] [27].

Learning can involve development of new knowledge internally, whereby the company focuses on its unique knowledge to create a long-term competitive advantage, or externally, when it sources new knowledge from outside. Internal knowledge development usually involves solid R&D effort, resulting in intellectual property in form of patents or trademarks. External knowledge search helps companies expand its boundaries by absorbing information from outside, most intensely through collaboration with others [3]. Collaboration can take various forms, from weak alliance between companies to corporate merger or acquisition transaction (M&A), where two or more companies become legally united [17]. Such corporate combination is a stimulated strategy to get access to additional knowledge, creating new opportunities [1].

The interplay between the internal and external dimensions of organizational learning practices has been a topic of vast research. Some scholars argue that those are two alternatives yielding to similar results, i.e. can be viewed as substitutes [19] or complementing strategies [8]. At the same time, other research has also emphasized that the two strategies are of a distinct nature [18], with some calls for non-complementarity as well [4].

It has been demonstrated that internal knowledge development effort facilitates absorption of external knowledge [6] [25] or even is its crucial determinant [16].

On another note, some earlier works have also demonstrated that it is rather external learning that is the determinant of internal creation of new knowledge [14].

Further, some research has stressed out that the companies should be striving towards balance between the two learning strategies [21]; with indication that deficiency in one element can trigger inappropriate over-exploitation of the other [16]. On top of that, there have also been calls for superiority of external learning [7] [2].

Both learning strategies are adding to organizational performance [24] [25], with some peculiarities proposed. Such, some studies revealed that as external knowledge search outpaces internal development, the overall performance starts to suffer [4], while other suggested dominance of external learning [15]. It has also been argued that the impact of learning on corporate performance is not linear – it adds to results at a lower end, while becoming deteriorating after a certain knowledge level is achieved [18] [23] [26].

Building up on the earlier literature and focusing on the two strategies for corporate learning, this paper raises the following research questions, attempting to uncover the patterns of interdependencies between the strategies:

- Does external knowledge search add to the internal knowledge stock of a firm?
- Does internal knowledge stock add to external knowledge search practices?

II. METHODOLOGY

This paper uses a quantitative approach, comparing the means of two populations – one representing companies focusing on external knowledge search strategies and another one, focusing on internal knowledge development. Separate tests are conducted for each research question, assuming unequal variances of the means.

For the purposes of this research, external knowledge search is proxied by binary variables of company's M&A activity, separately for three categories (acquisition of another company, registering a change in ownership i.e. becoming an acquisition target, or selling part of own business or subsidiary) and internal knowledge stock is measured by the overall count of intellectual property (patents and trademarks) registered by the companies.

Inclusion of all three dimensions of M&A activity provides a detailed insight into the corporate development strategies, especially given that firms tend to maintain certain patterns in this respect [5]. Those three dimensions capture the whole range of M&A activities, ranging from gaining direct access to external information through acquiring to disposing the knowledge which is no longer required in the company [12] [9].

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III. RESULTS

A. Sample description

The study utilizes data on European information-and-communications technology (ICT) companies that have at least one registered patent as of end of 2017, what is considered a proxy for higher knowledge-intensity of the company and is also a common measure used in the organizational learning literature [10][13]. The data includes information on M&A activities of those companies as well as their total patent count.

The data was derived from the Mergermarket and Amadeus databases. The final sample includes 425 ICT companies registered and operating in the EU.

B. The impact of external knowledge search on internal knowledge stock

Comparison of two populations – European ICT companies that have utilized external knowledge search techniques in form of any sort of M&A activity and those that have not done so – reveals considerable differences in the mean values of the patents they own (Table I).

Such, it appears that the companies that have been involved in acquiring or divesting other companies possess considerably higher stock of internal knowledge, compared to the companies who opt for internal knowledge development – 2938.9 and 39.0 patents for those who have completed acquisitions and for those who have not engaged in takeovers, respectively; as well as 7959.2 and only 44.8 patents for the companies that have sold part of its operations and that have not, respectively.

TABLE I
INTERNAL KNOWLEDGE STOCK (PATENT COUNT) BASED ON EXTERNAL KNOWLEDGE SEARCH EXPERIENCE

	Yes	No
Acquisition of another company	2 938.9	39.0
Change in ownership	64.4	682.2
Selling part of own business or subsidiary	7 959.2	44.8

* variable significant < 5% significance level, ** <1% significance level, *** 0.1% significance level

At the same time, acquisition seems to happen more with companies that have less patents, as the average number of patents for the companies that have registered change in ownership is only 64.4, compared to 682.2 in case of the companies that remained controlled by the same beneficiary. Development of a solid internal knowledge in a way acts as a protection against takeover, decreasing its likelihood.

However, none of the mean differences revealed appears statistically significant.

The results suggest that the companies with higher knowledge stock tend to be more involved in acquiring and divesting activities. The difference is of a large magnitude and statistically significant for selling – the companies with higher count of patents are more often engaged in divesting parts of the business or subsidiaries (mean value 0.118 compared to 0.015 in case of lower knowledge stock). For acquiring transactions, the difference is of a smaller magnitude – 0.208 compared to 0.167 At the same time, higher knowledge stock triggers a change in ownership – although the difference is rather marginal (0.181 in case of lower knowledge stock and 0.136 in case of higher stock).

TABLE II
EXTERNAL KNOWLEDGE SEARCH PRACTICE BASED ON INTERNAL KNOWLEDGE STOCK (PATENT COUNT)

	High knowledge stock	Low knowledge stock
Acquisition of another company	0.208	0.167
Change in ownership	0.136	0.181
Selling part of own business or subsidiary	0.118***	0.015***

* variable significant < 5% significance level, ** <1% significance level, *** 0.1% significance level

IV. DISCUSSION

Investigation of the interplay between internal and external knowledge strategies reveals exciting patterns of choices the companies make in pursuing their learning strategies.

Although some previous works have signaled that external and internal learning strategies can be very similar [4] [8], the findings of this paper are more in line with the view that the strategies are of a distinct nature [18]. Comparing the mean values of different populations, based on exposure to M&A transactions or the level of knowledge within the company demonstrates considerable differences. Such, active engagement in acquisitions and, surprisingly, divestments, acts as a knowledge management strategy results in a higher stock of internal knowledge generated – measured as the overall count of intellectual property possessed by the company. This might be adding to the presumption of higher benefits coming from external learning [7] [2], but additional investigation would be needed to make solid conclusions in this respect. Interestingly, the results also demonstrate that lower internal knowledge makes company more prone to becoming a takeover target, i.e. internal accumulation of knowledge acts as a certain protection against takeover.

External learning choices based on the level of knowledge stock at firm's possession also demonstrates considerable differences. Low level of internal knowledge suggests higher likelihood for engaging in knowledge search through corporate acquisition or in divesting some part of own business or subsidiary. A company turning to acquisitions can be viewed as a shift between the strategies – if internal development needs to receive a further boost, the company can turn to external sourcing,

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once again suggesting the distinction between the two strategies [18]. Similarly, the probability of divestment increases with number of patents, implying a movement towards clearer focus. The large and statistically significant mean difference in this area most likely symbolizes higher focus of operations, digging into the debate on the benefits of the depth or breadth of knowledge base [22]. Contradicting the mean patent count values for the companies engaged in transactions, the data reveals that becoming an acquisition target is more likely for companies with higher internal knowledge.

V. CONCLUSION

The goal of the paper was to investigate the interplay between the two dimensions of organizational learning - internal knowledge creation and external knowledge sourcing. Given the turbulence of the contemporary business world, learning and advancement are important determinants of long-term corporate survival [22]. That raises a question on the ways the distinct knowledge creation strategies complement one another.

The results of the study are value-adding in several ways. First, the study tackles the two knowledge development strategies – internal and external knowledge sourcing simultaneously. Second, it reveals interesting patterns on the differences between the companies that focus on external knowledge source by engaging in corporate combinations and divestures; and those who rely on organic knowledge development.

Based on a sample of European information-and-communications-technology firms, this research demonstrates that external knowledge sourcing in form of acquisition or divesture of other companies helps companies achieve a higher knowledge stock, measured as number of patents registered. At the same time, the companies being acquired possess a fewer patent stock.

Similarly, the companies with higher knowledge stock tend to engage more in corporate combinations (acquisitions) or divestures, while lower knowledge stock is positively related to the probability of being acquired.

The paper calls for further research on the interplay between the two learning dimensions, revealing factual dependencies as well as most beneficial strategies, adding to long-term competitiveness of the companies.

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Publication II

Kiisk, V., & Rungi, M. (2020). Knowledge cannibalism in the European ICT sector. *The Learning Organization,* 27(4), 305–319. (ETIS 1.1.)

Knowledge cannibalism in the European ICT sector

Valeria Kiisk
School of Business and Governance, TalTech, Tallinn, Estonia, and
Mait Rungi
Estonian Entrepreneurship University of Applied Sciences, Tallinn, Estonia and Estonia School of Business and Governance, TalTech, Tallinn, Estonia

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Abstract

Purpose – Based on the sample of the European information and communications technology (ICT) companies, this paper aims to identify which strategy of knowledge generation is most beneficial for companies: internal knowledge development or absorption of knowledge external to the company through corporate acquisition or merger.

Design/methodology/approach – In this study, a longitudinal analysis of European ICT companies was conducted, contrasting internal knowledge creation, in the form of patent accumulation and research and development (R&D) efforts, with external learning through merger-and-acquisition (M&A) activities to uncover the best strategies for performance maximization.

Findings – Results suggest that the two knowledge generation strategies are not complementary and demonstrate only marginal impact on organizational performance. However, intriguing patterns in combining the two became apparent. It was found that patent accumulation improves learning achieved through M&A activities, while also acting as a protection against corporate takeover. At the same time, the internal knowledge generation strategy was found to have a negative impact on financial performance, with external knowledge generation demonstrating somewhat mixed results.

Practical implications – This paper provides practical insights into the patterns of internal and external knowledge generation activities. The two strategies were found not to be complementary, implying that companies must carefully choose their preferences.

Originality/value – This large-scale study tackles the interplay between internal and external knowledge generation strategies, which are mostly studied separately. It reveals new patterns in corporate acquisition and divestment strategies as sources of new knowledge. It also ties the knowledge paradigm to organizational performance.

Keywords Europe, ICT firms, Mergers and acquisitions, Patents, Organizational learning

Paper type Research paper

Introduction

Modern business environment is dynamic and fast-paced, triggering companies to strive for constant development (Coombs and Bierly, 2006). Organizational learning or ability of a company to re-shape itself in light of external changes is a crucial component of business survival, placing learning in the centre of corporate strategy (Levinthal and March, 1993). Learning, or the corporate ability to capture external changes and create new knowledge, is shaped by organizational absorptive capacity (ACAP), a firm-specific capability (Wang and

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Ahmed, 2007) that allows firms to "recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal, 1990, p. 128).

New knowledge can be sourced externally by general market-search practices as well developed internally via research and development (R&D), whereby the company organically expands the knowledge it possesses (Sahaym *et al.*, 2010). While many studies on organizational learning have concentrated on external knowledge absorption, there is also a tendency for research on internal knowledge generation (Baškarada *et al.*, 2016). However, in search for long-term competitiveness, companies try to balance internal and external knowledge generation strategies, e.g. by collaborating with others (Ben-Oz and Greve, 2015).

Internal knowledge creation is focused on in-house research, targeting the creation of proprietary and unique knowledge. Access to external information is either gained by general market screening or can be further induced in a unique scenario, whereby two (or more) knowledge bases come together and interact as part of a merger-and-acquisition (M&A) transaction between the companies. This grants companies prompt access to additional resources, such as technology, assets, people and knowledge, allowing, among other, for an increase in market power (Ahuja and Katila, 2001). Access to the partner's resources and know-how can potentially be value-enhancing, adding to various facets of organizational performance, including product development, export growth and financial performance (Wang and Zajac, 2007). However, it has also been noted that mere access to knowledge is not sufficient as the company has to be able to absorb the information and there has to be a process of making use of the new enlarged knowledge base following the transaction (Kim and Inkpen, 2005). Still, as much as 60%-70% of such transactions tend to be value-deteriorating (Draulans *et al.*, 2003).

Earlier research concurs on the co-existence on internal and external knowledge generation strategies (Sahaym *et al.*, 2010; Lewin *et al.*, 2011; Wuyts and Dutta, 2014), while little effort has been made to understand which of the two is more beneficial for performance, focusing mostly on the routines behind the two (Benson and Ziedonis, 2009; Lewin *et al.*, 2011). This paper aims to identify which knowledge generation strategy is more beneficial for financial performance and if the strategies can be complementary. Based on a review of earlier literature on the topic, outlined in the following section, this paper attempts to answer the following research questions:

RQ1. Are external and internal knowledge generation related? If so, to what extent?

RQ2. Do the external and internal elements of knowledge generation impact organizational financial performance? If so, to what extent?

To answer these questions, a study was conducted based on longitudinal data for information and communications technology (ICT) companies in Europe for the period of 2008–2015.

This paper is structured as follows. The next section provides an outline of earlier research with the purpose to elaborate on the hypotheses' development. It is followed by an overview of the methodology applied in the paper. In the following section, the results are presented, followed by the discussion. The paper is finished by providing concluding statements.

Hypotheses development

In recent years, there has been a considerable development in the literature on knowledge generation. First, a much-needed development of the ACAP framework has taken place, as

called for by Todorova and Durisin (2007). Also, more emphasis has been placed on internal and external dimensions of knowledge generation, as outlined below.

A conceptual paper by Lewin *et al.* (2011) divided the knowledge generation phenomenon into internal and external dimensions. Focusing on routines, they proposed that the internal dimension envisages processes within a firm that are targeted at selecting, processing and making use of information sourced from outside, whereas the external dimension is concerned with managing the use of new knowledge in an external environment, with subsequent assimilation of results as part of internal knowledge development.

Sahaym *et al.* (2010) argued that R&D investment, as internal, and venture capital investing (M&A), as external knowledge generation strategy, were acting very similarly, suggesting their complementarity. Their notion regarding R&D investment being inflexible led to a more dynamic model of venture capital investing in which the acquisition of other companies implied also buying in new knowledge. Thus, the internal and external elements of knowledge generation could be complementary, addressing various needs of a firm – something suggested already by ACAP pioneers Cohen and Levinthal (1990). Sahaym *et al.* (2010) also demonstrated that R&D investments created a capacity for the company to identify and exploit technology and knowledge from acquisition targets, and also increased the likelihood of an acquisition transaction happening. This suggests that the internal elements of knowledge generation act as an input for external knowledge uptake. This argument was also supported in Benson and Ziedonis's (2009) earlier work, which demonstrated that technology-intensive corporate acquisitions were beneficial only if the acquirer's internal knowledge base was strong. They proved that a persistent pattern of venture investing (i.e. acquiring) led to greater returns. They also showed, however, that external knowledge generation through investing was not positively correlated to the internal one – the argument further developed to show that technology-intensive corporate acquisitions differ significantly from the previously described R&D investment context (Sahaym *et al.*, 2010). Benson and Ziedonis (2009) also observed that, in cases where the relative magnitude of acquisitions increased compared to R&D, the overall performance suffered, adding to the body of literature on interlinks between knowledge generation strategies. Challenging the earlier notion on knowledge being path-dependent (Cohen and Levinthal, 1990), Posen and Chen (2013) demonstrated how internal knowledge generation processes of new market entrants facilitate the intake and use of totally new external information. Further, they also showed that a lack of internal knowledge makes companies search for wider market information more intensively.

Summarizing the contrasting views on the interplay between the internal and external knowledge generation, the following hypotheses are formulated:

H1. Internal knowledge generation positively impacts external one.

H2. External knowledge generation positively impacts internal one.

Earlier research concluded that knowledge development helps firms sustain competitive advantage (Lane *et al.*, 2001) as well as perform better financially (Tsai, 2001). However, there has also been a contrasting view, stressing that different aspects of it might even undermine performance (Hitt *et al.*, 1991; Kumar, 2009). On a more general note, Weigelt and Sarkar (2012) demonstrated that both internally and externally managed knowledge-generating projects could provide benefits.

Swift (2016) demonstrated that the internal part of knowledge generation is a crucial element for a company, allowing it to distinguish between promising and failing R&D projects, as well as helping to balance between exploration and exploitation. At the same

time, Carlo *et al.* (2012) demonstrated that radical innovation within the IT sector is path-dependent and driven by existing knowledge diversity within a firm. It has also been shown that internal knowledge generation helps companies commercially apply their internal research endeavours as well as facilitate exploitation, also in the form of imitation (Lane *et al.*, 2001).

Wales *et al.* (2013) suggested that the relationship between knowledge development within an organization and its performance has an inverted U-shaped form, where the lower end of knowledge development effort is beneficial for financial advancement, whereas the higher end of it can be performance-deteriorating. They argued that the earlier literature on the phenomenon had ignored the costs associated with maintaining ACAP and sustaining novelty. A similar type of relationship was also suggested earlier by Rothaermel and Alexandre (2009). They demonstrated that knowledge generation is an important mediator for both internal and external technology sourcing, adding to performance at its lower end and limiting benefits at a higher end of the scale. Also, Zhou and Wu (2010) demonstrated a curvilinear relationship between technological capability and product innovation, arguing that the initial positive effect on innovative output is mediated by knowledge generation and further declines through organizational inertia.

Knott (2008) discovered an inverse relation between financial returns and R&D spending, a typical operational measure for internal knowledge generation. She argued that the relation was guided by an innate ability of a company, implying that the companies with higher profitability invest in R&D more (and not the opposite). While studying a classical relationship between knowledge generation and innovativeness (Cohen and Levinthal, 1990; Ahuja and Katila, 2001), Cepeda-Carrion *et al.* (2012) and Holan and Phillips (2004) demonstrated that an unlearning context of organizational forgetting as a managed activity aimed at changing routines within a company is an instrumental factor influencing overall performance.

Summing up the findings from previous research, the following hypothesis is proposed:

H3. Internal knowledge generation positively impacts organizational performance.

M&A, as an important source of new knowledge, has also been seen as a separate capability, forming a new routine of external knowledge generation and enhancing post-transaction performance (Basuil and Datta, 2017). Hoffmann (2007) argued that cooperation between companies is most likely to result in superior profits. Wuyts and Dutta (2014) showed that the diversity of the alliance portfolio was an important determinant of superior performance, mediated by organizational ACAP. They demonstrated that, while high diversity considerably increased the likelihood of creating innovative products, there were benefits to very small alliance diversity, specializing in a specific field. They also showed that existing internal knowledge was a facilitator of knowledge generation within a diverse alliance setting.

Bergh and Lim (2008) demonstrated that ACAP helps companies extract solid results from corporate restructuring (focusing on spin-offs and sell-offs) in cases where these are made recurrently. They further demonstrated that firms tend to create and maintain specific patterns in their activities. Zaheer *et al.* (2010) demonstrated that prior alliancing with potential acquisition targets improves the post-acquisition performance in cases of cross-border transactions.

Kähäri *et al.* (2017), in their study on multinational corporations, revealed that a decline in business volumes was strongly related to deficient ACAP – e.g. regional headquarters tended to lose their mandate if they were incapable of using the knowledge they gained

externally from parent company, supporting the role of knowledge generation in the corporate context.

In addressing all facets of the M&A context, the benefits sought by the buyer are evident – expansion in the knowledge base. Also, failures in this process, mostly minor ones, help to learn (Meschi and Métais, 2015). At the same time, selling activity is also a determinant, as the seller benefits from achieving an understanding of "how to evaluate the market" and "how to progress through the pre-merger process" (Doan *et al.*, 2018, p. 255). This is especially strong if the selling activity is recurrent (Brauer *et al.*, 2017). To be able to execute a good sale, the seller needs to have a good ability to share the knowledge with the buyer, i.e. a disseminative capacity, which is one of the elements of knowledge generation (Minbaeva, 2007). Knowledge is formed not only by good divestments, but companies can also create new knowledge from negative cases of corporate restructuring (Panibratov and Brown, 2018). Divesting helps companies to be more focused and efficient (Brauer *et al.*, 2017), gain technological leadership, improve learning processes, fund other activities, set a clearer business focus (Srivastava and Wang, 2015) and help companies in subsequent divestures (Brauer and Laamanen, 2016). Some companies select purposefully who could be potential acquirers or acquisition targets and cooperate with potential future buyers. For example, IBM cooperates with smaller ICT players to identify new ideas and teams to hire through acquisition of their companies (Matsumoto, 2019).

Schildt *et al.* (2012) uncovered an inverted U-shaped pattern within alliances. They demonstrated that similarities in technological knowledge did not allow for considerable knowledge generation in the initial stages of the relationship but caught up later as the alliance progressed. At the same time, diversity allowed for a rapid increase in the knowledge stock in the beginning, which evaporated over time.

Summing up earlier research inconsistencies, the final hypothesis is formulated as follows:

H4. External knowledge generation positively impacts organizational performance.

Research model

To test the hypotheses proposed, a two-step approach was deployed (Figure 1). First, the interrelationship between external and internal knowledge generation strategies was tested. External knowledge generation is represented by M&A activity, a strategy allowing prompt access to external knowledge, whereas internal knowledge generation is represented by

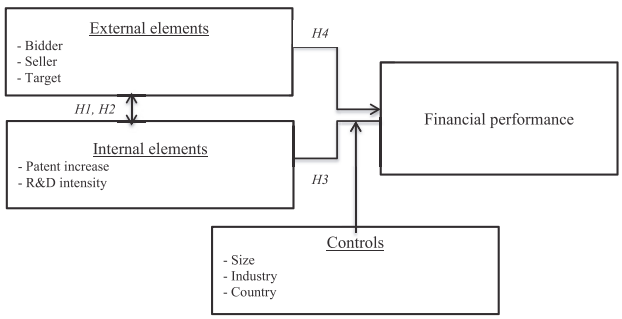

Figure 1.
Research model: interaction between the elements of knowledge generation and their impact on financial performance

more general and gradual knowledge development within the organization through R&D investments and patenting (Yu *et al.*, 2016).

Second, separate as well as joint effect of both internal and external knowledge generation blocks was tested against organizational financial performance.

Methodology and sample description

Methodology

In this paper, quantitative methods of analysis were applied to address the hypotheses, allowing for large-scale contrasting of the two knowledge generation strategies, based on quantitative indicators. The data set comprised the longitudinal data tracking companies' development over an extended period of time. A longer period was considered to smooth out temporary fluctuations that might arise because of the costs associated with either of the strategies.

A panel data regression analysis was run to understand the interrelationships between the variables and to test the hypotheses. Main variables and control variables were incorporated as suggested in earlier literature. No variable lags were included as no persistent patterns were identified in the earlier literature. The analysis was conducted in STATA.

Variables

The external knowledge generation dimension was proxied by M&A activity in terms of a firm's experience as a *bidder* (buying another company); *seller* (selling part of its business, e.g. subsidiary, division); or *target* (firm being an object of an acquisition itself). All three elements of M&A activity were included to capture the whole range of activities – starting from obtaining access to new knowledge through acquisitions, to disposing the knowledge deemed less valuable as part of organizational forgetting through selling parts of the company (Holan and Phillips, 2004; Cepeda-Carrion *et al.*, 2012). Successful divestment creates opportunities to improve firm efficiency (Brauer *et al.*, 2017) and can be especially beneficial if done recurrently (Brauer and Laamanen, 2016). Both acquisition of other firms and becoming a target of an acquisition transaction are important elements to external knowledge generation, as both create access to new knowledge bases (McConnell and Nantell, 1985), creating new opportunities for knowledge generation (Tsai, 2001). At the same time, organizational forgetting helps to increase learning and innovation as it helps firms stay focused (Srivastava and Wang, 2015), especially when combined with ACAP (Kluge *et al.*, 2019).

Internal knowledge generation was captured by two operational elements, both being classical measures of internal knowledge development: increase in firms' patent count (*patent increase*) (Ahuja and Katila, 2001; Narasimhan *et al.*, 2006; Flatten *et al.*, 2011) and *R&D intensity*, measured as the proportion of R&D costs to turnover (Flatten *et al.*, 2011; Tsai, 2001).

Financial performance was used as a proxy for organizational performance, measured by four constructs to capture the differences between size, asset base and operations of the companies studied and to cross-validate the results: *return on assets*; *asset turnover*; *return on sales*; and *return on fixed assets*. Accounting-based measures of financial performance have been largely favoured by scholars, with return on assets used most widely (Coombs and Bierly, 2006), especially when investigating social performance as is the focus in this research (Richard *et al.*, 2009).

Several control variables were also included. The natural logarithm of employee number was used as a proxy for company *size*, reflecting the size dispersion within the sample. *Country* and *sector* were used to capture geographical and sector specifics.

Sample description

Data used for this research contain measurements of 123 European ICT companies that possessed protected intellectual property (patents) and that had completed any sort of M&A transaction over the period 2008–2015 (i.e. had been involved as a bidder, seller or target of a business combination). Analysis of the data was performed by adopting the panel data random effect model. No lags were included into the model as no clear time-specific lag has been identified in the earlier literature. The random effect model accounts for the variability of data. The data for the study were obtained from the Mergermarket and Amadeus databases.

A total of 50% of the sample consisted of large companies (250+ employees), followed by medium-sized companies (50–249 employees, 32%) and small enterprises (10–49 employees, 11%). A total of 7% of the sample consisted of microenterprises. Among others, large companies included Deutsche Telekom, Vodafone, Orange, British Telecommunications and Verizon. ICT services represented 68% and manufacturing of ICT equipment 26% of the sample; the remaining was formed by ICT trade companies.

Results

Connection between external and internal knowledge generation strategies

The results of the analysis on the interrelation between the internal and external knowledge generation strategies, reported in Table 1, are somewhat surprising. While external practices, proxied by the M&A activity, demonstrated marginal, although consistently positive, effects on patent accumulation, it was discouraging R&D efforts. At the same time, patent growth and R&D intensity, the subsets of internal knowledge generation, persistently showed a mostly negative impact on the external knowledge development – aside from a company being a seller, in which case it benefited from internal knowledge generation activity. This leads to the partial rejection of *H1* and the partial acceptance of *H2*.

A firm owning patents was most likely to divest a part of its operations ($\beta = 0.121$, $p < 0.01$). From the opposite perspective, a firm was slightly more probable to be a target of an M&A transaction if it was investing in R&D ($\beta = 0.007$), whereas ownership of patents entailed a small negative influence on this probability ($\beta = -0.006$). This might suggest that the acquirers were interested in gaining access to new potential for patent development, not the patents themselves. Internal knowledge generation within the company showed mixed results on the probability to acquire other companies (patents entailed a slightly positive impact: $\beta = 0.004$; R&D, $\beta = -0.025$).

M&A activity also shaped choices within internal knowledge generation: any sort of M&A activity decreased the probability of internal R&D endeavours ($\beta = -0.008$, $\beta = -0.030$, $\beta = -0.310$ for bidder, seller and target, respectively), while slightly contributing to the patent creation ($\beta = 0.085$, $p < 0.01$ and $\beta = 0.002$ for seller and target, respectively).

Interestingly, some of the sectors reported persistent patterns. For example, the telecommunications sector opted for M&A activity rather intensively; the probability for being a bidder or seller was higher for these companies ($\beta = 2.717$, $p < 0.001$ and $\beta = 2.111$, $p < 0.01$ for wired telecommunication activities and $\beta = 0.704$, $p < 0.05$ for wireless telecommunication activities, respectively). Also, there was a considerable probability for firms in certain industries to become targets of an acquisition transaction: software publishing ($\beta = 0.328$, $p < 0.1$); computer programming ($\beta = 0.445$, $p < 0.01$); other information-technology and computer-service activities ($\beta = 0.557$, $p < 0.05$); and manufacturers of computers and peripheral equipment ($\beta = 0.513$, $p < 0.1$). Another control variable, size, reported mixed results on the probability of a firm engaging in M&A activity or developing internal knowledge.

Table 1.
Interaction between external and internal dimensions of knowledge generation

Variable	External						Internal			
	Bidder		Seller		Target		Patent		R&D	
External										
Bidder							0.024	0.000	−0.005	−0.008
Seller							0.122**	0.085*	−0.028	−0.030
Target							−0.012	0.002	−0.018	−0.310
Internal										
Patent	0.030	−0.004	0.142**	0.121**	−0.063	−0.006				
R&D	−0.019	−0.025	−0.084	−0.090	0.027	0.007				
Control										
Size		0.035		−0.175^{+}		−0.042		0.059		−0.054
Country										
DE								1.656**		
FR								1.165^{+}		
UK								1.174^{+}		
SE								1.190^{+}		
Sector										
2,640										0.646*
4,651								−0.763*		
5,829						0.328^{+}		−0.661**		
6,201								−0.861***		
6,202						0.445**		−0.691**		
6,203								−1.542*		
6,209						0.557*		−0.798**		
2,620		0.861^{+}		−0.856^{+}		0.513^{+}				
6,110		2.717***		2.111**						
6,120						0.704*				
Prob > Chi^2	0.906	0.001	0.005	0.000	0.491	0.291	0.021	0.000	0.672	0.219
R^2 within	0.002	0.000	0.011	0.011	0.001	0.001	0.003	0.005	0.005	0.008
R^2 between	0.092	0.341	0.139	0.361	0.050	0.260	0.141	0.392	0.001	0.195
R^2 overall	0.048	0.275	0.104	0.282	0.006	0.063	0.073	0.229	0.002	0.201

Notes: $^{+}$Variable significant at a 10% significance level; *5% significance level; **1% significance level; ***0.1% significance level

Interestingly, some countries were more likely to produce firms owning patents: Germany ($\beta = 1.656, p < 0.01$); France ($\beta = 1.165, p < 0.1$); the UK ($\beta = 1.174, p < 0.1$); and Sweden ($\beta = 1.190, p < 0.1$). At the same time, some sectors had lower patent generation: wholesale of electronic and telecommunication equipment and parts ($\beta = -0.763, p < 0.05$); other software publishing ($\beta = -0661, p < 0.01$); computer-programming activities ($\beta = -0861, p < 0.001$); computer-consultancy activities ($\beta = -0691, p < 0.01$); computer facilities management activities ($\beta = -1.542, p < 0.05$); and other information technology and computer service activities ($\beta = -0.798, p < 0.01$).

Impact of knowledge generation strategies on organizational performance

The impact of the two knowledge generation strategies on organizational performance, reported in Table 2, appears to be somewhat inconsistent. There is, to a large extent, evidence against *H3*, with two elements within internal knowledge generation exercising a negative impact on performance indicators. There was also a certain inconsistency with respect to the impact of external knowledge generation elements, posting mixed results on *H4*.

External knowledge generation practices, i.e. firm engagement in M&A transactions, reported mixed results on all subsets of financial performance, although the impact was not of a considerable magnitude. Experience of acquiring other companies slightly added to the return on assets and return on sales ($\beta = 0.036$ and $\beta = 0.054$, respectively), whereas being inferior to asset turnover and return on fixed assets ($\beta = -0.018$, $\beta = -0.002$, respectively). Experience of divesting subsidiaries or shares of a business was largely inferior across financial performance indicators – return on assets ($\beta = -0.004$), asset turnover ($\beta = -0.010$) and return on sales ($\beta = -0.006$) – while having a slightly positive influence on the return on fixed assets ($\beta = 0.038$). Being a target of an M&A transaction, the companies were more likely to have slightly higher return on assets ($\beta = 0.049$), return on sales ($\beta = 0.030$), and return on fixed assets ($\beta = 0.020$), while being inferior regarding asset turnover ($\beta = -0.015$).

The elements within internal knowledge generation also demonstrated distinct impacts. While patent growth reported mixed results across the performance subsets ($\beta = -0.047$, $\beta = 0.005$, $\beta = -0.038$, $\beta = -0.031$ for return on assets, asset turnover, return on sales and return on fixed assets, respectively), R&D intensity had a strong negative influence on all four performance indicators ($\beta = -0.061$, $\beta = -0.270, p < 0.001$, $\beta = -0.028$, $\beta = -0.004$, correspondingly). The influence was surprising: while R&D is indeed a cost, bringing down the performance of a firm, in the long run, those costs should result in additional sales revenue and improvements in profitability, adding to the performance indicators, especially because the data set covered an eight-year period. However, the results were the opposite: R&D negatively affected performance.

Firm size reported a rather positive influence on performance, except for the impact on asset turnover, where size had a negative influence. This could be explained by the fact that larger companies usually have more assets, making it more difficult to successfully turn them around, i.e. generate enough revenue. Among the countries, Switzerland reported a trend of higher return on fixed assets ($\beta = 1.208, p < 0.1$). Sector-wise, there were unexpected observations as well. While having a significant positive impact on return on sales ($\beta = 1.042, p < 0.1$, $\beta = 1.179, p < 0.1$, respectively), wired- and satellite-telecommunication activities reported a strong negative impact on return on fixed assets and asset turnover ($\beta = -1.660, p < 0.01$, $\beta = -1.464, p < 0.05$ and $\beta = -1.054, p < 0.1$, $\beta = -1.958, p < 0.05$, respectively). Asset turnover tended to be higher for the manufacturers of consumer electronics ($\beta = 0.987, p < 0.05$) and hardware management

Table 2.
Impact of knowledge generation on organizational performance

Variable	Return on assets			Asset turnover			Return on sales			Return on fixed assets		
External												
Bidder	0.010		0.036	−0.015		−0.018	0.045		0.054	−0.036		−0.002
Seller	−0.016		−0.004	−0.018		−0.010	0.006		−0.006	0.001		0.038
Target	0.019		0.049	0.004		−0.015	−0.000		0.030	0.029		0.020
Internal												
Patent		−0.061	−0.047		−0.011	0.005		−0.039	−0.038		−0.041	−0.031
R&D		−0.060	−0.061		−0.248***	−0.270***		−0.024	−0.028		0.008	−0.004
Control												
Size			0.022			0.076			−0.002			0.037
Country												
Switzerland												1.208^{+}
Sector												
2620												1.373***
2640						0.987*						
5829												0.533*
6110						−1.054^{+}			1.042^{+}			−1.660**
6130						−1.958*			1.179^{+}			−1.464*
6200												−1.395*
6201												0.412^{+}
6202												0.545*
6203						1.363^{+}						
6311												
Prob > chi^2	0.975	0.040	0.896	0.924	0.000	0.000	0.862	0.828	0.567	0.704	0.807	0.000
R^2 within	0.001	0.005	0.006	0.000	0.069	0.080	0.000	0.004	0.001	0.005	0.002	0.001
R^2 between	0.015	0.003	0.100	0.060	0.062	0.316	0.024	0.001	0.145	0.001	0.015	0.328
R^2 overall	0.223	0.007	0.096	0.045	0.054	0.311	0.014	0.000	0.133	0.002	0.007	0.256

Notes: $^{+}$Variable significant at a 10% significance level; *5% significance level; **1% significance level; ***0.1% significance level

($\beta = 1.363$, $p < 0.1$), whereas return on fixed assets was boosted for the manufacture of computer and peripheral equipment ($\beta = 1.373$, $p < 0.001$), software publishing ($\beta = 0.533$, $p < 0.05$), computer programming ($\beta = 0.412$, $p < 0.1$) and consultancy activities ($\beta = 0.545$, $p < 0.05$), and lower still for computer programming ($\beta = -1.395$, $p < 0.05$).

Discussion

The results described above allow to partially reject *H1*, partially accept *H2* and reject *H3*. The evidence on *H4* reports mixed results.

The paper has demonstrated that internal knowledge generation strategy, realized through patenting and R&D and the more rapid external knowledge generation strategy, focused on M&A, were not supporting one another. Evaluation of the relationship between the two strategies revealed that they are partly detrimental to one another (*H1* and *H2*), i.e. somewhat cannibalising one another, supporting the view of their non-complementarity revealed earlier by Benson and Ziedonis (2009) and Posen and Chen (2013), and providing evidence against the view expressed by Sahaym *et al.* (2010), who argued that the external and internal knowledge generation strategies supported one another. The present study found a tendency for the negative influence of internal knowledge generation on external one. There could be various reasons for this link: for example, Kähäri *et al.* (2017) suggested difficulties in reaching similar knowledge-processing capabilities in certain areas, whereas Benson and Ziedonis (2009) blamed a weak internal knowledge base.

An interesting pattern can be observed with respect to the patents: an increase in the number of patents stimulated a firm's selling activity, while decreasing its probability of becoming a target of an acquisition transaction itself. This is fully in line with the view expressed by Bergh and Lim (2008), who argued that in the M&A context, the acquirer is interested in taking over the potential for patent creation, not the patents themselves. As soon as the patent potential is realized, a unit can be divested, and unnecessary information disregarded, supporting the view of the importance of the unlearning context and placing focus on the most promising topics (Cepeda-Carrion *et al.*, 2012; Holan and Phillips, 2004).

Results are inconsistent with the findings of Weigelt and Sarkar (2012), who posited that both internal and external knowledge generation strategies are beneficial for performance. Moreover, the results contradict the general premise on the benefits of knowledge generation (Tsai, 2001; Lane *et al.*, 2001), supporting a negativistic view of its role (Hitt *et al.*, 1991; Kumar, 2009). As the relationship to performance was also earlier found to be curvilinear (Rothaermel and Alexandre, 2009), the tendency for the negative performance might be the result of organizational inertia (Zhou and Wu, 2010), corporate restructuring problems (Bergh and Lim, 2008) or the lack of prior familiarity with partners (Zaheer *et al.*, 2010). It might also be regarded as a support for Sahaym *et al.* (2010), who argued that the two strategies address different needs of the company.

The impact of internal knowledge generation on performance was negative (*H3*), supporting the argument by Knott (2008) and contradicting the path-dependency suggested by Carlo *et al.* (2012). One possible reason for this was provided by Posen and Chen (2013), who argued that the internal knowledge generation of new market entrants might not be sufficient to achieve success – although the long period of data investigated should have helped all companies in the sample achieve certain market penetration. Also, the negative impact of internal knowledge generation can be viewed as related to the persistency of M&A patterns exercised by corporates (Bergh and Lim, 2008) or the instrumentalism of knowledge, which requires a certain element of forgetting to unlock the full potential (Ahuja and Katila, 2001; Cepeda-Carrion *et al.*, 2012), i.e. the companies might be stuck in the patterns they follow, without considering the alternatives.

Mixed results for the impact of the elements to external knowledge generation strategy on performance do not allow us to add to the discussion on its benefits (*H4*). Although earlier literature has suggested external knowledge generation being value-adding (Hoffmann, 2007; Schildt *et al.*, 2012; Basuil and Datta, 2017), the results of the present study show different directions and magnitudes. While external knowledge generation reports mixed impact, internal knowledge is value-deteriorating. Thus, a provisional conclusion could be that external knowledge sourcing is more beneficial. This fact might be the result of certain variables being omitted, such as the effects of combinations of similar or diverse knowledge bases. In this regard, some researchers are strongly advocating diversity in establishing corporate knowledge and learning combinations or alliance portfolio formations (Wuyts and Dutta, 2014). The results can also be impacted by episodic changes. In this context, Swift (2016) argued that the balance between internal and external elements shifts over time, based on corporate needs or the path-dependency of radical innovation – perhaps requiring a longer development pattern.

Conclusion

This paper explored the interplay between the internal and external knowledge generation strategies and investigated their impact on organizational financial performance. Using a longitudinal data for European ICT sector, the paper demonstrates that the strategies are of a very distinct nature, not complementing one another. While internal knowledge generation strategy tends to be value-deteriorating, external knowledge generation strategy reports mixed results, with some elements improving performance and others compromising it.

The results are adding to the body of literature on non-complementarity of the external and internal knowledge generation strategies (Benson and Ziedonis, 2009; Posen and Chen, 2013). They are also suggesting that the knowledge is rather performance-deteriorating, partially supporting the negativistic view, advocated by Hitt *et al.* (1991) and Kumar (2009). Thus, the impact of internal knowledge generation was demonstrated to be negative, in line with earlier works (Knott, 2008). The external knowledge generation strategy reported mixed results, thus, not adding to the prevailing view on the strategy being value-adding (Schildt *et al.*, 2012; Basuil and Datta, 2017).

The findings might be specific to the sector and geography chosen, as other sectors, with more widely spread R&D practices and higher dependency on intellectual capital (e.g. biotechnology, deeptech), might extract higher benefits from new discoveries achieved through internal knowledge generation. Similarly, there might be wider benefits achieved from external knowledge generation in the markets with higher M&A activity, such as in the USA.

This paper is value-adding in several ways. First, it adds to the discussion on the benefits of distinct knowledge generation strategies, shedding light on the relationship between internal and external knowledge generation. The relation was found to be not complementary; the two strategies are of a very distinct nature, not adding to one another. Also, the influence of internal knowledge generation on external knowledge development is value-diminishing. Second, the paper reveals certain patterns in corporate behaviour, e.g. a tendency of some companies to sell off units or subsidiaries after harnessing their patent-creating potential. Third, it examined the perspective of knowledge generation elements on organizational performance, revealing the persistently negative impact of R&D and the slightly negative influence of M&A activity. As both internal and external knowledge generation strategies demonstrate a negative impact on performance, a question is raised about the benefits of knowledge as such. Also, it might hint at the role of the factors

unaccounted for in this research or in earlier studies regarding the linkages behind organizational knowledge.

The paper also has a practical value. First, it demonstrates that internal and external knowledge development strategies are not complementary, signifying a deliberate and difficult choice that companies must make regarding their knowledge path. Second, it reveals that while M&A activity sometimes has a negative effect on firms' financial performance, it still outpaces the persistently negative impact that internal knowledge generation exercises on corporate financial performance via patenting and R&D. Knowing this, businesses can be encouraged to start exploring opportunities for knowledge expansion through M&A activity, as well as to maintain optimal focus by divesting frontier operations and business units. Internal knowledge generation efforts exercise a negative influence on financial performance, both in the short and long run.

Further research should be conducted to include more variables to understand potential other influences on the dimensions of knowledge generation. Replication of the study in other industries might also reveal further differences and variances (Evanschitzky *et al.*, 2007), even though this research is in and of itself an aggregated replication of earlier studies. Inclusion of additional variables and the use of different data sets could provide additional insights and would be welcomed.

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Corresponding author

Valeria Kiisk can be contacted at: valeria.kiisk@gmail.com

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Untangling the mystery of absorptive capacity: A process or a set of success factors?

Valeria Stulova*, Mait Rungi

Tallinn University of Technology, School of Business and Governance, Ehitajate tee 5, 19086 Tallinn, Estonia

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ABSTRACT

The absorptive capacity of an organization is its ability to translate the knowledge sourced from outside into commercial benefits. Having gained a certain academic interest, the mechanism of the absorptive capacity phenomenon is still puzzling. This paper provides some limited confirmation of earlier frameworks; however, absorptive capacity is demonstrated to be a set of interrelated success factors rather than a sequential process of knowledge articulation in a company. The new model of absorptive capacity proposed encompasses four dimensions: continuing development, bottom-up innovation, trust-based internal cooperation, and deferred knowledge use. The continuing development facet entails a strong positive impact on organizational performance, while the bottom-up innovation dimension deteriorates it. Trust-based internal cooperation and deferred knowledge use report mixed results.

1. Introduction

An increasingly turbulent business terrain is pushing companies to compete fiercely and to produce new innovative solutions at regular and short time intervals (Bettis & Hitt, 1995; Menon, Chowdhury, & Lukas, 2002). The ability to come up with new ideas as well as to react promptly to innovative solutions proposed by competitors as well as to demands of partners, suppliers, clients, and other agents, is significantly influenced by how well a company is able to capture the value of external knowledge — and that, in turn, is determined by the absorptive capacity of the organization (Cohen & Levinthal, 1994). Absorptive capacity represents a firm's unique skill of translating externally generated knowledge into own commercial benefits.

Earlier research on absorptive capacity has demonstrated the importance of the phenomenon for a number of organizational performance indicators. While seen as a mediator by some scholars (Hutzschenreuter & Guenther, 2008; Saenz, Revilla, & Knoppen, 2011), absorptive capacity is mainly considered to entail a direct, significant, and positive influence on organizational performance indicators including innovative output (Cohen & Levinthal, 1990; Fabrizio, 2009; Tsai, 2001), competitiveness (George, 2005; Winter, 2003; Zahra & George, 2002), and financial performance (George, Zahra, Wheatley, & Khan, 2001; Rothaermel & Alexandre, 2009; Tsai, 2001).

Despite gaining a rather vast academic interest, the mechanism of the absorptive capacity phenomenon is still somewhat confusing (Lane, Koka, & Pathak, 2006; Todorova & Durisin, 2007) as the concept is intangible, challenging any attempt to quantify the studies of it (Jimenez-Barrionuevo, Garcia-Morales, & Molina, 2011). As such, earlier research has been criticized for its reliance on proxies capturing the phenomenon only partially (Murovec & Prodan, 2009).

* Corresponding author.
E-mail addresses: valeria.stulova@gmail.com (V. Stulova), mait.rungi@ttu.ee (M. Rungi).

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The current paper examines the prevailing understandings on the paradigm of absorptive capacity, attempting to reveal a model actually employed by the firms. Next, the paper proceeds in investigating the impact that the facets of absorptive capacity entail on organizational performance, both separately and in conjunction with environmental turbulence.

2. Theoretical background

Absorptive capacity, most often defined as "the ability of an organization to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990: 128), enables companies to develop through commercial application of knowledge sourced from outside.

The concept of absorptive capacity was introduced in 1989 by Cohen and Levinthal, who proposed that absorptive capacity consists of three stepwise elements of knowledge articulation within a company: recognition of the value entailed in the knowledge generated externally, its assimilation to firm's existing knowledge base, and application of a combined knowledge base for commercial purposes.

Later, several alterations to the model were proposed, with the most significant alternative model being that of Zahra and George (2002), who suggested a framework encompassing four stages — acquisition, assimilation, transformation, and exploitation of external information. They group the dimensions into two pairs: acquisition and assimilation as the potential to use the knowledge sourced from outside, and transformation and exploitation as realization of this potential. The nature of this differentiation is similar to the one proposed by March (1991) in the model of organizational learning — a company's potential absorptive capacity is exploratory in its nature, while realized absorptive capacity relates to exploitation of knowledge.

However, Garud and Nayyar (1994) argued that absorptive capacity as such is not sufficient to create a sustainable competitive advantage. They introduced transformative capacity to signify knowledge retention, bridging recognizing the value of external information to its usage — *i.e.* linking assimilation and application stages. Expanding their argument, Lichtenthaler (2009) tried to propose a model of absorptive capacity entailing six stages, with transformative learning linking exploration to exploitation.

Despite being rather intensively referred to by scholars, the concept of absorptive capacity is mostly given a brief notice (Lane et al., 2006). Although there is certain empirical support for sequential models in some specific contexts such as ICT (Daspit, 2012), some contrasting schemes have also been demonstrated. As such, Lane, Salk, and Lyles (2001) argued that absorptive capacity in an international joint venture context entails only two stages, demonstrating that the acquisition and assimilation stages as suggested by Cohen and Levinthal (1989) are highly correlated. Also, Heeley (1997) proposed that the actual use of new external knowledge depends on technological capabilities at a firm's possession, claiming that application cannot be considered a separate stage. It has been noted that the actual mechanism of the phenomenon remains unclear (Lane et al., 2006; Van den Bosch, Van Wijk, & Volberda, 2002).

The most important outcomes of absorptive capacity as proposed by Cohen and Levinthal (1989, 1990) are innovation and innovative output. Their view was expanded by numerous following studies (*e.g.* Ahuja & Katila, 2001; Fabrizio, 2009; Fosfuri & Tribo, 2008; Zahra & George, 2002), arguing further that absorptive capacity is central for sustaining the competitive advantage of a firm. The lack of absorptive capacity has been demonstrated to act as a major obstacle for a firm's agility, reducing its competitiveness (Szulanski, 1996). Despite being generally noted as contributing to competitiveness, the role of absorptive capacity for shaping the competitive position has been subject to limited research endeavours, with most of the studies equating competitive position either to innovative outcome (Ahuja & Katila, 2001; Fosfuri & Tribo, 2008) and/or financial performance (*e.g.* George et al., 2001; Rothaermel & Alexandre, 2009; Tsai, 2001). Other less quantifiable strategic outcomes that absorptive capacity has been demonstrated to determine include, for example, strategy formation (Volberda, 1998) and knowledge transfer (Kim & Inkpen, 2005; Mowery, Oxley, & Silverman, 1996).

In addition, organizational performance and the need to respond to the developments external to a firm are highly influenced by environmental turbulence (Levinthal & March, 1993). The speed of change occurring in the surrounding environment determines if a company should be focusing on exploratory or exploitative activities, with turbulent times favouring exploration (Bierly, Damanpour, & Santoro, 2009) and stable environments leading to exploitation (Koka & Prescott, 2008).

Considered to be stable before, the current business environment is characterised by continuous revolutions (Brown & Eisenhardt, 1997) — product development cycles are short (Mowery et al., 1996) and are constantly becoming shorter (Bettis & Hitt, 1995). The shortening product lifecycle is influenced by rapid changes in technology (Bettis & Hitt, 1995) as well as by the general movement towards incremental changes, promoting easy adoption and potential evolvement of early adopter gains (Coombs & Bierly, 2006; Tushman & Anderson, 1986). The contemporary environment is high-paced, with tight competition, great complexity, and an elevated degree of uncertainty (Emden, Calantone, & Droge, 2006; Leonard-Barton, 1992). However, the so-called threats entailed by the turbulence (Leonard-Barton, 1992) can also be sources of opportunity (Song, Droge, Hanvanich, & Calantone, 2005). Absorptive capacity is a dynamic capability (Wang & Ahmed, 2007; Zahra & George, 2002), a meta-capability over functional capabilities (Daspit, 2012), allowing for constant recreation of core competencies, helping sustain competitive advantage in a dynamic setting (Teece, Pisano, & Shuen, 1997). Also, being innovative in turbulent times requires companies to combine old and new knowledge (Henderson & Clark, 1990), a process that once again is shaped by absorptive capacity (Rothaermel & Alexandre, 2009). Thus, a high-velocity setting shall favour organizations with a well-developed absorptive capacity, calling for an investigation of the joint impacts of environmental dynamism and absorptive capacity on organizational performance.

Table 1
A summary of the dominant models of absorptive capacity.
Source: composed by the authors.

Process	Source
Recognize → assimilate → apply	Cohen & Levinthal (1989)
Acquire → assimilate → transform → exploit	Zahra & George (2002)
Recognize → assimilate → transmute → apply → maintain → reactivate	Garud & Nayyar (1994)
	Lichtenthaler, 2009

3. Methodology and data collection

3.1. Research model

The current research is determined to understand the mechanism of absorptive capacity, by testing the dominant models of the phenomenon proposed by earlier studies. Earlier models concur in several aspects (Table 1); however, the addition proposed by Garud and Nayyar (1994) complements the elements proposed by the theory pioneers (Cohen & Levinthal, 1989; Zahra & George, 2002). This is why the aggregated model, encompassing six stages, was mostly benchmarked against designing the current research and formulating the survey questions (Appendix 1).

Given the multidimensionality of the absorptive capacity construct and its ties to several organizational theories, the design of the survey was complex. The questionnaire developed is based on the scales introduced by earlier studies on the absorptive capacity concept as a dynamic capability, as well the scales used on related topics within the knowledge management and organizational learning bodies of research (Flatten, Engelen, Zahra, & Brettel, 2011a; Flatten, Greve, & Brettel, 2011b; Jimenez-Barrionuevo et al., 2011; Noblet, Simon, & Parent, 2011; Pavlou & El Sawy, 2011; Szulanski, 1996; Watkins & O'Neil, 2013).

The research model of this paper is summarized in Fig. 1. The first goal of the study is to investigate the dimensionality of the absorptive capacity phenomenon. Next, the impact of absorptive capacity dimensions, coupled with environmental turbulence, shall be examined relative to organizational performance.

Several methods of data analysis are applied to tackle the data on the dimensionality of absorptive capacity: traditional frequentist analysis in the form of an exploratory factor analysis (EFA), Bayesian dependency modelling (BDM), and non-metric multidimensional scaling (MDS). The results shall be interpreted independently of one another, aiming to capture the full complexity of the phenomenon investigated as well as to cross-validate the results.

Frequentist analysis is dominating the contemporary academic research (Wylie, Muegge, & Thomas, 2006). Initially, the techniques of frequentist and Bayesian analysis were developing together, becoming seen as opposites later on (Zyphur & Oswald, 2013). While frequentist methods see probability as an attribute of what share of total population has a certain property, the Bayesian analysis gives an estimation of the probability of every individual observation having a certain property (Wylie et al., 2006). The Bayesian dependency modelling technique used herein determines clusters of variables that resemble the dimensions of absorptive capacity, revealing “the most probable statistical” dependencies among the variables (Nokelainen, 2008: 120–121), based on joint

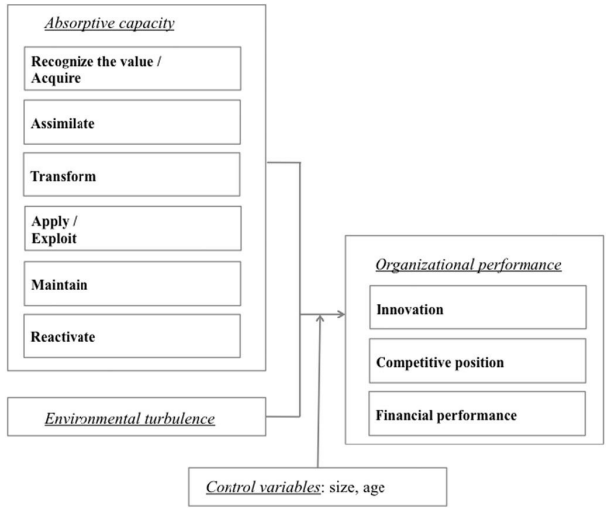

Fig. 1. Research model.
Source: composed by the authors.

probability distribution (Myllymäki, Silander, Tirri, & Uronen, 2002). It has been pointed out that complementary use of frequentist and Bayesian methods can provide a better insight of the phenomena studied (Zyphur & Oswald, 2013). Also, while frequentist exploratory factor analysis fits well with large data sets (over 300 observations) (Pallant, 2001), Bayesian analysis fits well also for small datasets (Nokelainen, 2008; Zyphur & Oswald, 2013).

MDS is a data mining technique, offering an additional lens to the analysis on the dimensionality of absorptive capacity as it assumes a non-linear relationship between the variables as opposed to a strictly linear one required by EFA (Taguchi & Oono, 2005).

Following a comprehensive three-stage analysis of the absorptive capacity mechanism, a regression analysis is performed to assess the impacts that the dimensions of the phenomenon entail on organizational performance.

3.2. Variables

The authors carefully selected the instruments used in the earlier studies as well as added some questions in order to operationalize the data and capture the specifics of it.

3.2.1. Dependent variables

The current research attempts to capture the impact of the elements of absorptive capacity on several facets of organizational performance: innovation, financial performance, and competitive position of a firm. Perceptual measures are used to understand the performance of the firms in the three areas investigated, capturing increasing, decreasing or stable trends of the organizations studied. The *innovation* is herein approximated to the new product/service development. Net *profit* is used as a proxy of financial performance. Competitive position is approximated to the *market share* held by the company in its target market.

3.2.2. Independent variables

Absorptive capacity. In order to obtain a comprehensive picture of the absorptive capacity phenomenon, 22 questions were developed, grounded in past research as outlined earlier in the paper.

Environmental turbulence is a composite variable uniting 8 questions, each trying to capture a distinct element of the business terrain (*e.g.* the speed of technological change, shifts in customer preferences).

3.2.3. Control variables

Two control variables were included: firm *size* and *age*. Following Tsai (2001) and Fosfuri and Tribo (2008), *size* is measured as a natural logarithm of the number of employees in the period studied. An *age* variable was measured as the number of years since a company's establishment until 2013 (Fabrizio, 2009; Lee & Huang, 2012).

The full list of variables is provided in Appendix 1.

3.3. Data

This research utilizes data gathered in Estonia, an exceptional EU country — having population of only 1.3 mln, it is a unique environment, outpacing its peers in multiple areas. Estonia stands as the 16th best country in the world in terms of ease of doing business (World Bank, 2016), is 9th worldwide (and 3rd best in Europe) in economic freedom (Heritage Foundation and Wall Street Journal, 2016) and is the 30th best globally in general economic competitiveness (World Economic Forum, 2016a). Also, it possesses valuable human capital, superior to those of even larger economies — the PISA students' score stands at 526 (compared to the OECD average of 497), 91% of grownups have completed upper secondary education (the OECD average stands at 76%) (OECD, 2014) as well as the overall rank of the quality of the human capital residing in the country is the 16th best worldwide (World Economic Forum, 2016b). Complex digital solutions (including e-residency, e-government) and successful global companies that have started in Estonia (*e.g.* Skype, GrabCAD, Fortumo) suggest that Estonia is a European alternative to Silicon Valley (Giang, 2014). Estonia receives a solid inflow of foreign direct investment (in 2015 it amounted to 17.4 bn EUR — or 85% of the country's total GDP of 20.5 bn EUR (Statistics Estonia 2016)) and is an open economy. Everything mentioned above makes Estonia a perfect setting for research on absorptive capacity. Moreover, the proximity of the country positioning in global rankings and indices to rapidly growing economies of Asia, such as Singapore and Hong-Kong (Feldmann & Sally, 2002), and several Northern and Eastern European areas, suggests that the results could be generalizable to those countries as well as start-up areas such as Silicon-Valley (USA) and Nice (France), as well.

3.4. Sample description

The data for this research was obtained by means of a self-administrated survey targeting profit-seeking companies in Estonia.

The questionnaire was pre-tested in several stages among students and academic personnel of the Tallinn University of Technology (Estonia). The final version of the survey encompassed 22 questions aimed at capturing the dimensionality of absorptive capacity, most of them measured on a 5-point Likert scale. 2–5 measures were constructed per every variable (expected dimension of the phenomenon investigated), as suggested for multi-item scales (Venkatraman & Grant, 1986). Additional questions were used to collect the data for other variables (environmental turbulence, control variables of age and size, indicators of organizational performance). All questions addressed the situation in the companies and their developments within the 2010–2012 period. The questions are listed in Appendix 1. The survey was available in Estonian and Russian.

An online-based survey was sent out to 455 companies, registered in Estonia, in October 2013. The companies were randomly selected by undergraduate students at the Tallinn University of Technology. 135 responses were received (30% response rate). Most represented industries included retail and wholesale trade industry (20% of all responses), manufacturing (18%), and construction (13%). Based on the number of employees, the sample is well-balanced as well: micro-enterprises accounted for 27% of all responses, small enterprises 32%, medium-sized companies 23%, and large-sized companies 18%. The tests on sample and non-response bias did not reveal any considerations for further analysis.

The sample size used for the study is modest (135 responses); however, it is sufficient to ensure the applicability of the methods chosen, with 6.2 observations per every variable examined, above the 5 variable threshold suggested for EFA (Hair, Black, Babin, & Anderson, 2009) as well as suitable also for BDM and MDS. It is also adequate for pursuing the following regression analysis.

The correlation coefficients among the variables describing the phenomenon studied range between 0.01 and 0.75, averagely 0.19, *i.e.* the correlations are modestly high, supporting the use of additional methods to improve the reliability of EFA. The error term on a considerable portion of the variables associated with the absorptive capacity phenomenon (16 out of 22) is not normally distributed.

Harman's single-factor test is a known statistical remedy to control common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003: 889) — in the current dataset no single independent variable component explained more than 26.86% of the total variance. The total number of components with eigenvalue above 1 was 7, and the total sum accounted for 72.51% of the total variance. Cronbach's alpha of the absorptive capacity variables (22 items) stands at 0.87, and the Kaiser-Meyer-Olkin value for sampling adequacy is 0.69, which is satisfactory for EFA purposes (Pallant, 2001). The Kaiser-Meyer-Olkin value increases to 0.83 for the final solution as described further in the paper. Cronbach's alpha of the environmental turbulence variable is 0.81. That is, the data obtained can be further processed according to the analytical models described above.

4. Results

In order to reveal the dimensionality of the absorptive capacity concept, three distinct analytical procedures are carried out as described above, with independent interpretation of results.

4.1. The model of absorptive capacity

The EFA solution reveals a four-dimensional structure of absorptive capacity (Table 2). Out of the 22 variables studied, 14 are included in the final factor solution. The other variables were dropped due to their low commonalities, *i.e.* limited contribution to the factor solution discovered (Fabrigar, Wegener, MacCallum, & Strahan, 1999).

The EFA solution proposes four interrelated dimensions of the absorptive capacity phenomenon. Factor 1 encompasses variables focusing on firm evolution: support for learning of employees, importance of industry trends for strategy development, support of new product/service development, improvements of internal processes and technological solutions, and constant search for new knowledge applications. This dimension is labelled “continuing development”.

Factor 2 signifies internal cooperation; the dimension is composed by three variables capturing exchange of information, cooperation effort, and trust within organization. The dimension is labelled “trust-based internal development”.

Factor 3 stresses out the role of employees for firm advancement. It unites measures on the ability of the employees to recognize

Table 2
Results of the exploratory factor analysis.
Source: composed by the authors.

Variable	Factor 1	Factor 2	Factor 3	Factor 4
2			0.692	
3			0.844	
4			0.767	
6	0.572			
7		0.754		
8		0.878		
9		0.668		
11	0.786			
12	0.747			
13	0.788			
14	0.786			
17				0.712
18				0.766
19	0.527			
Eigenvalue of the factor	5.20	1.30	1.26	0.67
Variance explained	0.65	0.16	0.16	0.08

Loadings under 0.45 not depicted. Variables with uniqueness over 0.6 dropped.
Oblique rotation was performed to retrieve factor loadings. Variables are listed in Appendix 1.

Table 3
Correlation coefficients between dimensions.
Source: composed by the authors.

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1			
Factor 2	0.43	1		
Factor 3	0.40	0.31	1	
Factor 4	0.28	0.35	0.17	1

the value of new trends, to generate new ideas as well as to apply those ideas for benefits of the organization. The dimension is labelled “bottom-up innovation”.

Factor 4 relates to the knowledge preservation and reactivation within organizations. It comprises two measures: the willingness to maintain valuable knowledge over extended time periods as well as the ability to retrieve this knowledge for later use. This dimension is labelled “deferred knowledge use”.

The dimensions identified are moderately interrelated (Table 3), suggesting a certain co-movement of the facets. Positive correlations demonstrate that the facets of absorptive capacity support one another.

The result of EFA is to be interpreted with caution since the solution resulted in an ultra-Heywood case, with the model explaining over 100% of the total variance. Uneasy to explain mathematically, the ultra-Heywood case is considered to be a coherent step of exploratory factor analysis by some scholars (*e.g.* Suhr, 2005), whilst others argue that interpretation of the results might be problematic (*e.g.* Fabrigar et al., 1999).

The BDM solution proposes a similar dimensionality (Fig. 2). The results demonstrate that all variables are related, and no single item was left out of the structure. However, they all are scattered around one variable (variable 21), suggesting its centrality. This variable focuses on application of knowledge older than 1 year, what might symbolize a strategic shift — only most recent information is valuable, older knowledge becomes out-of-date and of limited business value, supporting the argument on shortening product lifecycles and shrinking strategic periods (Menon et al., 2002).

The BDM solution produced five distinct clusters encompassing at least three variables. In addition, the model produced six bipolar links, which were disregarded.

The clusters identified by this method suggest a five-dimensional mechanism of absorptive capacity — supporting the four facets identified by EFA and suggesting one additional item. The dimensions of bottom-up innovation, trust-based internal cooperation, and deferred knowledge use unite the same variables as the solution yielded by EFA, adding variable 21 to every subset. The continuing development subset replaces variable 6 with central to this solution variable 21. The additional cluster proposed by this method is related to the deferred knowledge use dimension: they both address the storage of valuable knowledge over time. However, if the deferred knowledge use subset identified by EFA is linked to maintaining the knowledge due to appreciating the value it entails, then the additional dimension revealed here relates to the knowledge preservation required by internal rules of organization. This dimension is labelled “enforced data maintenance”.

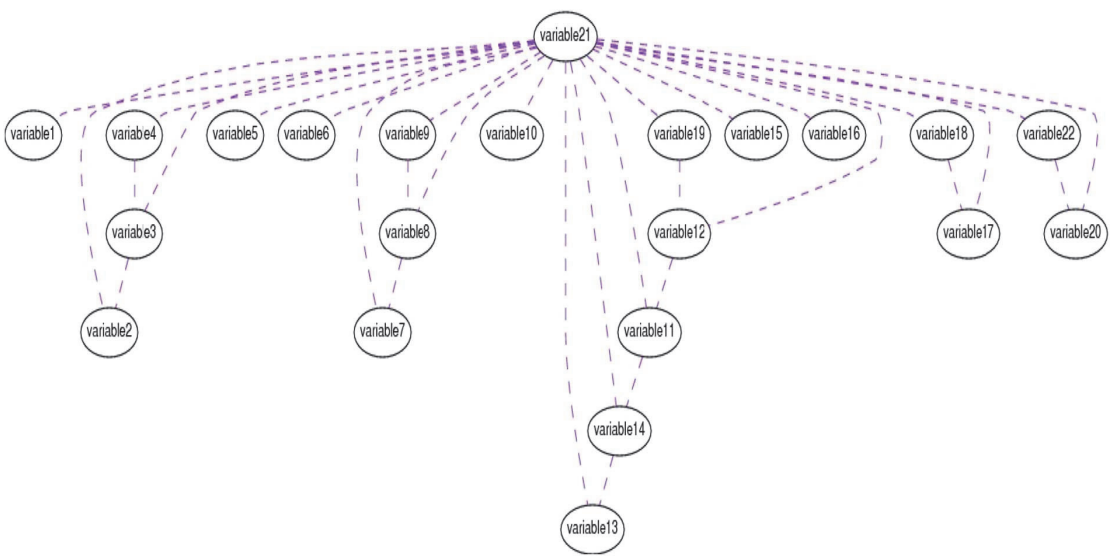

Fig. 2. Results of the Bayesian dependency model.The full list of variables is provided in Appendix 1.
Source: composed by the authors.

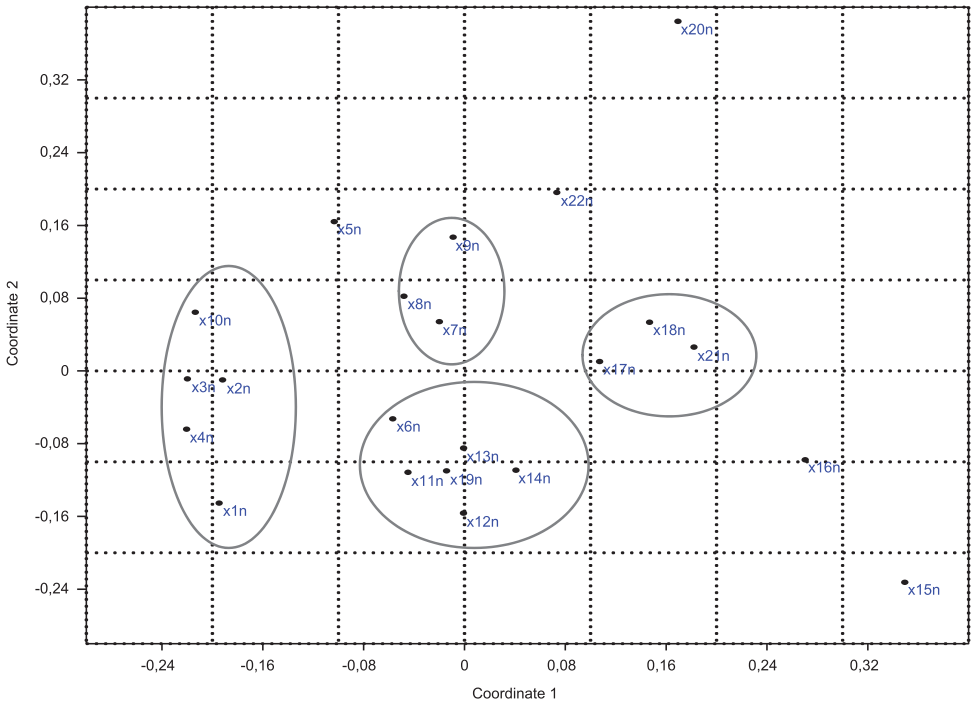

Fig. 3. Results of the non-metric multidimensional scaling.The full list of variables is provided in Appendix 1.
Source: composed by the authors.

The results of MDS echo the outcomes of EFA and BDM (Fig. 3). Four dimensions were revealed by this method, concurring to a large extent with the results of EFA, adding two additional measures to the "bottom-up innovation" dimension and one measure to the dimension labelled "deferred knowledge use". The variables that MDS has more in abundance compared to the EFA solution were dropped out in carrying out the latter due to their low communalities as described above.

Despite the inherent differences of the analytical frames used in this research and certain concerns with EFA (modest sample size, largely non-normal distribution of errors, ultra-Heywood case), the three methods reached very similar results (Table 4).

The dropping out of variables due to their low communality made by EFA did not diminish its comparability to the results of the other two methods since most of the variables dropped were demonstrated to have limited relevance for the solutions of the other two methods (bipolar links in the BDM, considerable distance from other variables in MDS). The concurrence of the three methods allows drawing conclusions with respect to the dimensionality of the phenomenon under investigation.

The final model of absorptive capacity proposed herein embraces four dimensions, uniting variables that were supported by at least two out of the three methods used (Fig. 4).

The model of absorptive capacity proposed signifies the importance of *continuing development* — it suggests that in order to learn, a firm should promote development of employees, it should account for new industry-wide trends, improving technological processes, and internal working mechanisms, it should constantly develop its product/service offering as well as be on the lookout for new opportunities to apply its existing know-how. Next, absorptive capacity encompasses *bottom-up innovation* — involving bright people who are able to capture the value of market trends, to propose new ideas as well as to realize them. The dimension of *trust-based internal cooperation* advocates that knowledge creation requires trust-based internal cooperation between departments, based on

Table 4
Summary of the results.
Source: composed by the authors.

	EFA	BDM	MDS
Continuing development	6, 11–14, 19	11–14, 19, 21	6, 11–14, 19
Bottom-up innovation	2–4	2–4, 21	1–4, 10
Trust-based internal innovation	7–9	7–9, 21	7–9
Deferred knowledge use	17–18	17–18, 21	17–18, 21
Enforced knowledge preservation		20–22	

The full list of variables is provided in Appendix 1.

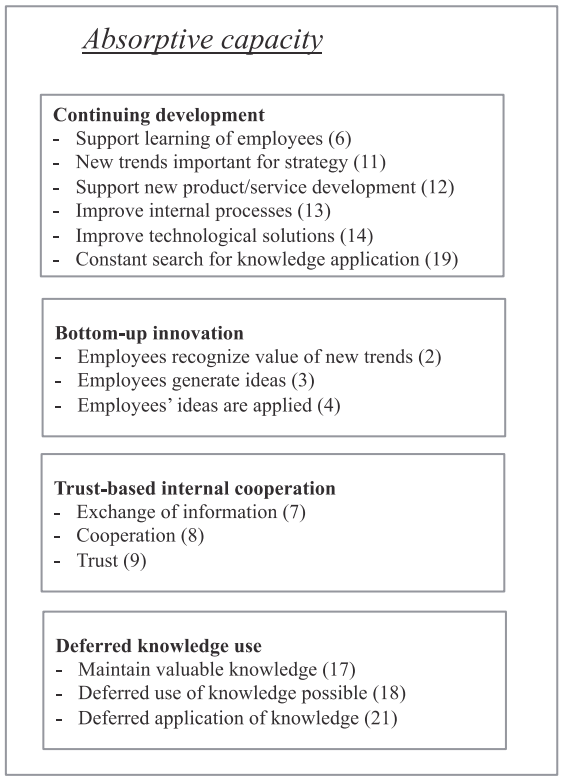

Fig. 4. Proposed model of absorptive capacity.The number of variables is noted in parentheses; the full list is provided in Appendix 1.
Source: composed by the authors.

information flow, and trust. The *deferred knowledge use* dimension encourages proper preservation of valuable knowledge, allowing for its later use as well as actual reactivation of the knowledge accumulated earlier as suggested by Garud and Nayyar (1994). This suspended use of knowledge enables companies to extract only the knowledge that is of a value in a given situation.

4.2. The impacts on organizational performance

Next, the paper proceeds to capture the influence of the proposed subsets of absorptive capacity on organizational performance as outlined in the Methodology and data collection section.

The results demonstrate that the proposed dimensions of absorptive capacity entail direct and considerable impact on

Table 5
The impact of absorptive capacity dimensions on organizational performance.
Source: composed by the authors.

	Innovation		Profit		Market share	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Continuing development	0.928*	1.198*	0.468	0.879	0.742*	1.069*
Bottom-up innovation	− 0.326	− 0.226	− 0.562	− 0.439	− 0.565	− 0.271
Trust-based internal cooperation	0.238	− 0.135	− 0.076	0.007	− 0.010	− 0.148
Deferred knowledge use	− 0.389	− 0.503	− 0.019	− 0.262	0.309	0.200
Environment		− 0.359		− 0.784		− 0.773
Size		− 0.326		0.058		− 0.121
Age		0.004		0.008		0.012
Prob > chi^2	0.091	0.061	0.422	0.339	0.151	0.164
Pseudo R^2	0.053	0.093	0.025	0.055	0.047	0.077

* $p < 0.05$. Results of ordered logit regression analysis, non-parameterized coefficients.

organizational performance (Table 5). However, only the *continuing development* dimension is a persistently positive determinant of organizational performance, while other dimensions can be deteriorating performance as well.

Continuing development has a strong positive influence on *innovation*, *profit*, and *market share*, signifying the importance of growth orientation for the overall company development. *Bottom-up innovation* exercises modest negative influence on the performance indicators investigated, diminishing the idea of employee initiative *per se*. The impact of *trust-based internal cooperation* is not conclusive for *innovation* and *profit*, whilst it affects *market share* slightly negatively. *Deferred knowledge use* is demonstrated to have moderate negative influence on *innovation* and *profit*, while adding to *market share*.

Environmental turbulence, which introduces a number of challenges the companies have to address in order to survive, is deteriorating organizational performance.

Age exercises marginal positive impact on performance, whilst company *size* is negative for *innovation* and *market share*, marginally improving *profit*.

5. Discussion

The current paper proposes a new, success-factor oriented model of absorptive capacity, pointing out the elements an organization should combine in order to improve its aptitude of utilizing external knowledge for own benefit. To be able to capitalize on external knowledge, an organization should consider four elements — *continuing development* mindset, *bottom-up innovation* of employees, *trust-based internal cooperation* across all units and capacity for *deferred knowledge use* (Fig. 4).

The dimension of *continuing development* signifies the importance of an organization's growth orientation on all levels (*e.g.* employees, technology, value offering) as a performance accelerator. The *continuing development* dimension relates to other functional capabilities such as “sensing business opportunities” and “product development” (Kolk & Rungi, 2012) or “adaptive capability” and “innovative capability” (Wang & Ahmed, 2007). Also, it goes in line with the “intuiting” part of organizational learning — linking the role of employees and organizational development (Crossan, Lane, & White, 1999). The people-related part of this dimension demonstrates a solid link to the organizational learning theory, where conscious and intentional learning at an individual level has been demonstrated to be central to the learning organization metaphor (Pedler, Burgoyne, & Boydell, 1991). At the organizational level, continuing development is more common for incumbents (Levinthal & Myatt, 1994), but *continuing development* is hard to practice for long due to the impossibility of dealing simultaneously with exploration and exploitation (Gupta, Smith, & Shalley, 2006). This link corresponds to the perceived similarities of the traditional models of absorptive capacity and of organizational learning (Sun & Anderson, 2010), plus organizational learning's more practical occurrences: the learning organization (Senge, 1990) and the intelligent organization (Albrecht, 2003).

Continuing development adds to organizational performance, improving *innovation*, *profit*, and *market share*. While there used to be few radical changes in the past, now technological solutions and product offerings are changing continuously (Bettis & Hitt, 1995; Brown & Eisenhardt, 1997; Menon et al., 2002) and the ability of companies to be at the edge of those developments is seen as a requisite to stay in competition (Coombs & Bierly, 2006). The environment is becoming increasingly competitive as more and more new companies enter the market (Beckman, Haunschild, & Phillips, 2004) and the competition turns out to be fiercer (Levinthal & Myatt, 1994). The competition is not only taking place in fields of goods, market shares etc., but also for capabilities themselves (Prahalad & Hamel, 1990). Thus, constant re-alignment of resources at an organizations' possession is central to organizational survival.

The evolvement of *bottom-up innovation* as a separate dimension symbolizes a shift from once dominant, yet demonstrated to be ineffective bureaucratic organizational structure (Pugh, Hickson, Hinings, & Turner, 1968). Transformational management style, which empowers employees through goal-setting and personal example rather than through top-down command line, has been proven to be the most beneficial for creation of new knowledge (Bryant, 2003) and, thus, for innovation. The role of employees and not the top management in being in touch with the environment and in knowing better where to direct endeavours has triggered the evolvement of the knowledge-based view, which sees every individual as a knowledge-creating entity (Spender, 1996). This signifies the role of all employees in searching of new ideas — their initiative, search for new sources of information, and willingness to contribute beyond the job description is a fundamental element of organizational learning (Walter, Lechner, & Kellermanns, 2013) and is also a crucial driver of the *continuing development* element.

The persistently negative influence of *bottom-up innovation* on organizational performance provides additional insight to the ongoing debate on internal idea generations within companies. As such, Burgelman (1991) argued that successful organizations are characterized by strategic initiatives of the top management as well as the entrepreneurial bottom-up effort of employees at any level, promoting experimenting and development of new solutions. He also proposed that it is the role of the middle management to promote bottom-up initiatives and it is the top-management responsibility to approve promising ideas (Burgelman, 1983). However, the bottom-up initialised projects might not be so popular compared to the outside-in projects (Markham, 2000) in contrast to the not-invented-here syndrome (Kessler, Bierly, & Gopalakrishnan, 2000; Menon & Pfeffer, 2003; Murovec & Prodan, 2009). Also, the extent of freedom for realization of one's ideas depends on how ambitious the initiative is; a low degree of bottom-up initiative is a sign of little freedom in an organization, discouraging future projects (McGrath, 2001). Zhao and Chadwick (2013) provide an additional argument for constraining bottom-up innovation, suggesting that an organization should focus on the overall innovative effort, suggesting that overall motivation level rather than diffuse endeavours is the main determinant of performance.

Another facet of absorptive capacity focuses on *trust-based internal cooperation* between employees. Earlier studies have demonstrated that knowledge transfer is most effective in a collaborative setting, signifying internal cooperation (Zhao & Anand, 2009). Compared to prompted cooperation, *trust-based internal cooperation* is usually preferred for its voluntary nature (Smid, Bijlsma-

Frankema, Derksen, & Bernaert, 2005); it also works well with *bottom-up innovation*, since less control is needed. Both *trust-based internal cooperation* and *bottom-up innovation* dimensions are also inherently important for knowledge-intensive works, supporting the notion of the knowledge worker, who generates ideas as the main output of work (Drucker, 1967). The dimensions of *bottom-up innovation* and *trust-based internal cooperation* are also closely aligned to the idea of communities of practice, gaining popularity worldwide. Communities of practice take cooperation to the whole new level, promoting sharing of information and learning (Hemmasi & Csanda, 2009). Not only do such communities enable information sharing, but they also allow for idea evolvement through collaborative discussion and retention of valuable knowledge over time (Nonaka, 1994), bridging those dimensions to the *deferred knowledge use* as well. As the same pair (*bottom-up innovation* and *trust-based internal cooperation*) emphasises internal knowledge sourcing, it also signifies that sourcing of external knowledge cannot be successfully performed without internal knowledge creation (Murovec & Prodan, 2009). Jansen, Van Den Bosch, and Volberda (2005) extend the argument further, emphasizing the necessity for cross-functional interfaces and socialization between the team members. Cross-functional roles and also job rotation add to employees' understanding of the business activities, enhance both cooperation as well as stimulate creation of new ideas.

Mixed influence of *trust-based internal cooperation* on organizational performance does not allow drawing certain conclusions. Earlier studies have advocated collaboration (Jimenez-Barrionuevo et al., 2011); it was suggested to be facilitating learning by helping transfer the data sourced from the outside into usable knowledge (Daft & Weick, 1984). On the other hand, any cooperation is based on trust (Uzzi, 1997) and trust is difficult to be examined *ex-ante* (Brass, Galaskiewicz, Greve, & Tsai, 2004: 802). Trust is based on prior positive experiences, but experience makes collaboration repetitive, which might not be beneficial for innovation (Baum, Calabrese, & Silverman, 2000). *Trust-based internal* cooperation is related to teamwork and similarly to the findings of this paper, and teamwork has been demonstrating mixed influence on performance in prior literature as well. Good teamwork is promoted in turbulent times where innovation is the key for company survival (Biedenbach & Müller, 2012) and the efficiency of teamwork is boosted by the high complexity of the tasks set (Hoegl, Parboteeah, & Gemuenden, 2003). Performance-deteriorating role of *bottom-up innovation* and mostly negative influence of *trust-based internal cooperation* revealed by the current study might be the price of low autonomy of teams or the unintentional outcome of the management practices in place (Amabile, 1998; Tatikonda & Rosenthal, 2000).

Deferred knowledge use exercises negative influence on organizational performance, and the direction of this influence is probably closely related to the evolvement of the *continuing development* dimension. Products and technologies are changing quickly and strategic periods are becoming shorter (Bettis & Hitt, 1995; Menon et al., 2002); thus, companies have to be development-oriented and search for new information and knowledge. Under those circumstances there seems to be no need or chance to utilize old information. Despite the fact that learning is cumulative and path-dependent (Bierly et al., 2009; Kim & Inkpen, 2005; Lane et al., 2006), it doesn't seem to be supporting reverting to old information. It has been even pointed out that “knowledge grows, and simultaneously it becomes obsolete as reality changes” (Hedberg, 1981: 3), implying that memory might act as a constraint for new knowledge accumulation (Starbuck & Hedberg, 1977). The prevailing belief that organizations have their own memory, which is independent of the individuals within it (Daft & Weick, 1984), suggests that vast knowledge can impede performance, driving a whole new direction of studies on organizational forgetting (Holan & Phillips, 2004).

This dimension is also related to the *trust-based internal cooperation* facet of absorptive capacity: Amiryany and Ross (2013) pointed out that it is not enough to preserve and have the knowledge within a firm, but there is need for explanations how to use and work with knowledge — and most effective way for this is face-to-face communication.

Earlier studies have demonstrated that the benefits of learning vary depending on the *environmental turbulence* — with exploitative learning having positive impact on innovative output in stable environments, while reducing innovation in turbulent times (Jansen, Van den Bosch, & Volberda, 2006). The general environmental turbulence gained a middling appraisal in the current research (mean value 3.25, measured on a 1–5 scale, with 1 representing low turbulence and 5 high turbulence), and, as expected, it entails a strong negative influence on organizational performance.

The proposed model concurs in certain aspects with earlier models of absorptive capacity (Cohen & Levinthal, 1989; Zahra & George, 2002). As such, *continuing development* starts with recognizing the value of external knowledge; *trust-based internal cooperation* dimension is to a significant extent built up on the measures used in earlier research to describe assimilation of external information.

One of the potential reasons behind only partial correspondence with earlier models might be the increasing dynamism of the markets. Absorptive capacity was initially introduced in 1989; since then the business terrain has been becoming increasingly international, the technologies used are getting more complex, and innovation is a key to leadership (Rothaermel & Alexandre, 2009). This dynamism could be the reason for the initial elements forming new combinations as well as for re-alignment of the mechanism of the absorptive capacity from the process to a set of success factors complementing one another. Absorptive capacity is often discussed within the dynamic capabilities framework (Wang & Ahmed, 2007; Zahra & George, 2002), which diverged from the resource-based view theory (Barney, 1991) also due to the increasingly high dynamism of the markets, diminishing the value of static competitive advantage and praising constant renewal of resources (Teece et al., 1997).

Still, the model proposed herein relates to Zahra and George's (2002) upper abstraction level, differentiating between potential and realized absorptive capacity. *Continuing development* and *bottom-up innovation* jointly build up the preconditions necessary to facilitate accumulation of knowledge both from internal and external sources, *i.e.* are of exploratory nature, shaping potential absorptive capacity. Then, *trust-based internal cooperation* and *deferred knowledge use* dimensions resemble the actual usage of new knowledge, *i.e.* are exploitative and define the realized effort. To create and sustain a long-term competitiveness, firms should balance between exploratory and exploitative dimensions (Junni, Sarala, Taras, & Tarba, 2013). And while there is a general tendency of

exploitation prevailing over exploration (Regner, 2003), then in the context of absorptive capacity both the earlier models and the model proposed by the current paper value equally both of them.

Some earlier studies on management strategies have envisaged the dimensionality of the absorptive capacity phenomenon as proposed by the current paper. As such, Bryant (2003) proposed that the transformational management style is the most beneficial for knowledge creation and sharing, suggesting an important role of goal-setting, personal example, and self-realization. The negative influence of *bottom-up innovation* revealed can be linked to the top-down management style still dominating the business terrain, limiting fulfillment opportunities and, thus, transformational learning.

The knowledge search practices model (Tippmann, Mangematin, & Scott, 2013) also has partial overlap with the current work, with the use of own experience, network, and within-group collaboration relating to *trust-based internal cooperation*, knowledge system — to *deferred knowledge use* and central role of middle managers in communicating the ideas of employees to the top management level — to *bottom-up innovation*. *Trust-based internal cooperation* has been demonstrated to be a link to the *continuous development* in earlier studies as well (García-Morales, Jiménez-Barrionuevo, & Mihi-Ramírez, 2011).

The non-linearity (Flatten, Greve, and Brettel, 2011) and a shift from a process to a set of success factors offer certain confirmation of absorptive capacity being a set of dynamic capabilities and their development techniques. Dynamic capabilities are developed by using different development techniques, with one of the techniques, for example, being the bottom-up approach (Brady & Davies, 2004) — relating further to the *bottom-up innovation* dimension identified by the current research. The dynamic nature of the absorptive capacity concept is also supported by the mainly negative influence of the *deferred knowledge use* facet on performance.

6. Conclusion

The mechanism of absorptive capacity proposed by the current paper is no longer a step-wise process advocated by earlier research. Instead, it is a conjunction of four success factors: continuing development, bottom-up innovation, trust-based internal cooperation, and deferred knowledge use. Those elements are to a certain extent related to the dimensions advocated by the traditional theory on absorptive capacity; however, the nature of the construct is considerably more dynamic.

Further, the paper demonstrated that continuing development has a persistent and positive impact on all subsets of organizational performance, while bottom-up innovation is deteriorating the results. Trust-based internal cooperation reported mixed results on organizational performance and deferred knowledge use adds only to the competitive position, affecting financial performance and innovation negatively.

The results of the study are value-adding in several ways. First of all, this paper provides an empirical investigation of the absorptive capacity mechanism. Secondly, the model of absorptive capacity discovered suggests only limited confirmation of earlier theories. Instead, this study argues that absorptive capacity is a set of success factors rather than a step-wise process. Next, the success factors revealed are demonstrated to have a clearly identifiable pattern of impacts on organizational performance, advising on what elements organizations should focus on in order to improve their performance.

Appendix 1. Survey questions

Measures of absorptive capacity.

Scale item in English	Notation[a]	Reference to earlier literature
Our employees follow industry trends	Variable 1	Flatten et al. (2011a, 2011b) Jansen et al. (2005) Pavlou & El Sawy (2011) Heeley (1997)
At least some of our employees are able to recognize the value of new trends (*e.g.* development technological solutions, product development, advancements in management practices, production process)	Variable 2	Zahra & George (2002) Flatten et al. (2011a, 2011b) Jansen et al. (2005)
At least some of our employees have come up with new ideas to foster our business	Variable 3	Zahra & George (2002) Jimenez-Barrionuevo et al. (2011)
At least some of our employees' ideas were applied	Variable 4	Additional variable proposed by the authors
We know who are our top performers	Variable 5	Flatten et al. (2011a, 2011b) Szulanski (1996)
We support continuous learning of our employees	Variable 6	Flatten et al. (2011a, 2011b)
There is a working exchange of information between departments	Variable 7	Zahra & George (2002)

		Jimenez-Barrionuevo et al. (2011) Flatten et al. (2011a, 2011b)
Our departments cooperate	Variable 8	Pavlou & El Sawy (2011)
There is trust between employees of different departments	Variable 9	Jansen et al. (2005)
We employ people with diversified knowledge	Variable 10	Szulanski (1996)
We account for new trends of our industry in setting strategic goals	Variable 11	Pavlou & El Sawy (2011)
We support development of new products and services	Variable 12	Heeley (1997) Jansen et al. (2005)
We constantly improve our working practices	Variable13	Lane et al. (2001) Szulanski (1996)
We constantly improve our technological solutions	Variable 14	Lane et al. (2001)
Labour turnover is beneficial for our company	Variable 15	Jansen et al. (2005)
When some employees leave, their knowledge remains within organization	Variable 16	Garud & Nayyar (1994)
We maintain valuable knowledge over extended time periods	Variable 17	Garud & Nayyar (1994)
The chosen method of maintaining information allows for its later use	Variable 18	Garud & Nayyar (1994) Flatten et al. (2011a, 2011b) Pavlou & El Sawy (2011)
We search for new opportunities to apply our knowledge (new markets, products, services)	Variable 19	Flatten et al. (2011a, 2011b)
Has your organization enforced a regulation on maintenance and archiving of data?	Variable 20	Jimenez-Barrionuevo et al. (2011)
Has your organization managed to commercially apply information that was archived for > 1 year?	Variable 21	Additional variable proposed by the authors
Our employees follow the regulations on data maintenance and archiving	Variable 22	Jimenez-Barrionuevo et al. (2011) Walter et al. (2013)

[a] Variables 1–19 and 22: 5-point Likert scale, “cannot say.” Variables 20 and 21: “yes”/”no,” “cannot say.”

Measures of environmental turbulence.[a]

Technological solutions used in our industry have changed
The products/services offered by our industry have changed
Technological developments have created new opportunities
Competition has intensified
Our major suppliers have changed
Our client/customer groups have remained the same
Preferences of our clients/customers have changed
Preferences of new clients/customers differ from old clients/customers

[a] All variables: 5-point Likert scale, “cannot say.”

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Publication IV

Rungi, M., & Kiisk, V. (2020). Exploring the elements of absorptive capacity: Large scale interview study of 61 companies in Estonia. *International Journal of Transitions and Innovation Systems*, 6(3), 199–218. (ETIS 1.2.)

Exploring the elements of absorptive capacity: large-scale interview study of 61 companies in Estonia

Mait Rungi and Valeria Kiisk*

School of Business and Governance,
Tallinn University of Technology,
Ehitajate tee 5, Tallinn 19086, Estonia
Email: valeria.kiisk@gmail.com
Email: mait.rungi@ttu.ee
*Corresponding author

Abstract: The increasingly dynamic business environment encourages companies to combine externally available information and internal ideas to maximise company performance. A company's ability to capture external knowledge and to use it for its own benefit is shaped by organisational absorptive capacity. Using data gathered from interviews with 61 Estonian companies, this research attempts to further investigate a recently proposed model of absorptive capacity suggesting that it is a set of simultaneous, rather than consecutive, elements. The paper provides an in-depth study of the suggested elements and patterns that make up the phenomenon of absorptive capacity and demonstrates that companies value external information, sourcing it and making their strategic choices based on the competitive situation. While providing support for the proposed model of absorptive capacity, the results also reveal common elements of its subsets: process-driven innovation, reliance on competitors and clients and the importance of employees.

Keywords: absorptive capacity; knowledge management; organisational learning; dynamic capabilities.

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Biographical notes: Mait Rungi is a Professor from the Tallinn University of Technology in Estonia. He has over ten years experience in both academia and industry, including positions such as an Associate Professor, CIO, Team and Project Manager. His current research is focused on strategic management aspects such as project portfolio management and dynamic capabilities, primarily in ICT industry. His publications have appeared in journals and various conference proceedings, including EURAM and EGOS. According to Google Scholar, he has 22 publications (mostly B-C category journals), average citation per publication is 4.1 and h index is 6. He obtained his DSc from the Lappeenranta University of Technology in Finland.

Valeria Kiisk is a PhD candidate from the Tallinn University of Technology and a partner with Redgate Capital in Estonia. Her primary interests of research are absorptive capacity, M&A and alliances. She obtained her MA in Business from the Tallinn University of Technology in Estonia as a Cum Laude and BSc in Economics and Business from the Stockholm School of Economics in Riga, Latvia.

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1 Introduction

The constantly changing business environment challenges companies on many different levels: the product development cycle is shorter than ever (Mowery et al., 1996) and new technologies are being regularly introduced (Bettis and Hitt, 1995), all triggering hyper-competition among companies [Barreto, (2010), pp.256–257] and leading to firms being uncertain about the future (Emden et al., 2006; Leonard-Barton, 1992).

These environmental pressures require companies to be agile, constantly re-shaping their core competences to meet the challenges of the changing environment (Teece et al., 1997). A firm’s learning ability is, therefore, key to its development, allowing it to refine its competencies and to adjust its position in the market, adapting to the challenges of the continuously changing environment (Mowery et al., 1996). The ability to capture and benefit from external influences and developments is determined by the absorptive capacity of an organisation, a capability that can be defined as ‘the organisation’s relative ability to develop a set of organisational routines and strategic processes through which it acquires, assimilates, transforms and exploits knowledge acquired from outside the organisation in order to create value’ [Jimenez-Barrionuevo et al., (2011), p.192]. It is most often seen as a dynamic capability (Wang and Ahmed, 2007; Zahra and George, 2002), helping companies sustain competitive advantage despite external changes (Winter, 2003). However, the phenomenon also has strong links to other organisational theories, such as organisational learning, innovation, the knowledge-based view, co-evolution theories (Volberda et al., 2010), the resource-based view (Barney, 1991) and network theory (Baum et al., 2000).

Despite receiving much attention from scholars, the concept of absorptive capacity has evolved rather slowly. The initial model, proposed by Cohen and Levinthal (1989, 1990), consists of three pillars and is defined as “the ability of an organization to recognize the value of new, external information, assimilate it, and apply it to commercial ends” [Cohen and Levinthal, (1990), p.128]. The next major advancement was made by Zahra and George (2002), who proposed a new, two-dimensional, four-staged model. They defined absorptive capacity as “a set of organizational routines and processes by which organizations acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability” [Zahra and George, (2002), p.186] and suggested that it has two dimensions – potential and realised absorptive capacity – emphasising that mere acquisition of new knowledge is not sufficient to achieve any results by using it.

Recently, a new model has been proposed, rooted in empirical study and revealing new connections in the phenomenon. Stulova and Rungi (2017) introduced a new, success-factor-based model of absorptive capacity. The model encompasses four dimensions: continuing development; bottom-up innovation; trust-based internal cooperation; and deferred knowledge use. They also demonstrated that the continuing-development facet has a strong positive impact on organisational performance, while the bottom-up-innovation dimension has a negative impact. The

model is ambitious in its nature, proposing a shift from a sequential process to a concurrence of several processes or success factors. However, it also has strong connections to earlier models and many other theories, including knowledge management, organisational learning, and dynamic capabilities. Due to its recency, unlike some other models, this model has not yet been further empirically verified [see, for example, Todorova and Durisin (2007) for Zahra and George's (2002) model].

The aim of the current paper is to explore the model of absorptive capacity proposed by Stulova and Rungi (2017) and to uncover more details on organisations' ability to commercially apply externally sourced information. The analysis is based on 62 in-depth interviews conducted with 61 companies in Estonia, an EU country characterised by a high degree of learning and innovation. A thorough content analysis of the interview data was performed, with continual reference to the literature, to reveal traits relevant to absorptive capacity.

The paper contributes to the existing body of research on absorptive capacity in several ways. Most importantly, it provides an in-depth study of a recently proposed non-sequential model of absorptive capacity. It also identifies the links between the facets of the absorptive capacity mechanism, demonstrating the relative importance of various subsets as well as placing absorptive capacity in the context of a general environmental turbulence. Finally, it provides a solid insight into the role of external knowledge sourcing for companies.

2 Literature review

The pioneers of the absorptive capacity construct, Cohen and Levinthal (1989, 1990), suggested a three-pillar construct that is "not resident in any single individual but depends on the links across a mosaic of individual capabilities" [Cohen and Levinthal, (1990), p.133]. They argued that knowledge absorption is a step-wise process consisting of recognising the value of external knowledge, assimilating it in to the organisation's existing knowledge base, and applying this newly combined knowledge to achieve commercial goals.

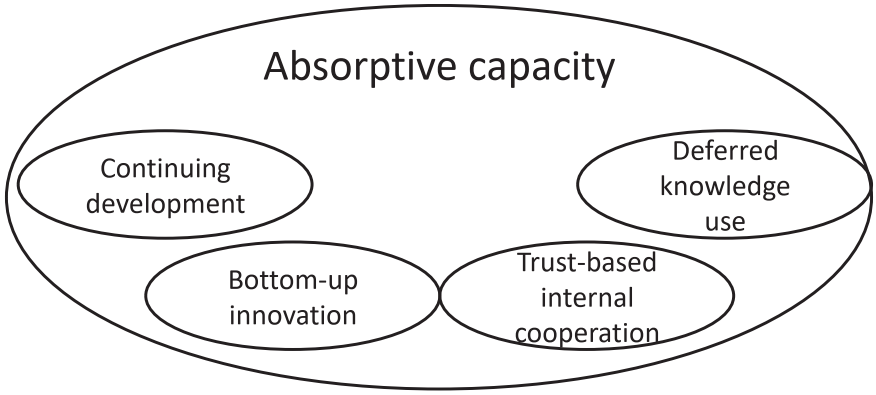
A major advancement in the model was proposed by Zahra and George (2002), who suggested that absorptive capacity comprises two levels – potential and realised absorptive capacity – reflecting the distinction between what could potentially be absorbed and what is actually absorbed. They further split these levels into four steps: the acquisition of external knowledge and its assimilation in to the knowledge base of the organisation, jointly shaping potential absorptive capacity; and the transformation of the pre-existing and new knowledge in to a combined knowledge and the subsequent exploitation of this combined knowledge, jointly shaping realised absorptive capacity.

Generally, the framework proposed by Zahra and George (2002) was welcomed by scholars and has received empirical validation (e.g., Flatten et al., 2011; Fosfuri and Tribo, 2008). However, it has also been criticised. For example, Todorova and Durisin (2007) proposed that the original model suggested by Cohen and Levinthal (1990) was superior. Drawing on empirical research, they offered several additions to the original model (such as feedback loops between stages), but their main argument was that a three-pillar structure explains the concept better than its division in to potential and realised capacity proposed by Zahra and George (2002).

Other studies have also challenged the structure of the absorptive capacity, although they have received only limited further validation. For example, Lane et al. (2001) concluded that the phenomenon encompasses only two dimensions as they found that the acquisition and assimilation stages are independent and different from the third stage, the ability to apply the knowledge, although they are correlated with one another. Similarly, Heeley (1997) argued that the exploitation of the external knowledge depends on a firm's technological capabilities and cannot be considered a separate step. Such attempts demonstrate a considerable interrelation between the elements and suggest that the phenomenon could be nonlinear in its nature.

A further development of this line of argument line was proposed by Stulova and Rungi (2017) who developed a new, non-sequential model of absorptive capacity. They argued that, although the elements of the phenomenon remain largely unchanged, these elements form new combinations, suggesting that, in the a dynamically changing environment, absorptive capacity is a set of success factors rather than a sequential process in which phases follow one another. Absorptive capacity is made up of four elements occurring simultaneously (Figure 1): the continuing development of a company's orientation, i.e., the continual development of its technology, offering, processes, and resources; bottom-up innovation, i.e., idea sourcing at all levels of management; trust-based internal cooperation, i.e., effective and reliable cooperation within a firm; and deferred knowledge use, i.e., the proper codification and effective mechanisms for retrieving prior knowledge.

Figure 1 The model of absorptive capacity



Source: Based on Stulova and Rungi (2017)

3 Methodology and data collection

3.1 Research method

Researchers of absorptive capacity have called for more qualitative research (e.g., Volberda et al., 2010), emphasising the need for an in-depth understanding of the phenomenon. Semi-structured, in-depth interviews were used here, in an attempt to see behind the general statements and descriptions that are common for strategic management and, especially, for intangible topics such as organisational learning.

This study used semi-structured interviews to collect the data. All the interviews were transcribed, and a thorough content analysis of the text was performed. The transcriptions were prepared following the generally accepted practices for documenting interviews, including all words said, omissions and pauses.[1] For each case, a thorough within-case analysis was performed, followed by a cross-case analysis. Both within-case and cross-case analyses were performed together with content analysis to gain a comprehensive overview of the case. Due to the volume limitations, the results section will mainly focus on the cross-case results, focusing on the tendencies as well as the extremes. The codes used were partly theory-driven and partly *in vivo* (data-driven) (Piekkari and Welch, 2008). Next, a frequency analysis was run to support the text data analysis across cases. NVivo software was used to carry out the text analysis. Unexpected findings triggered a need to revert to theory, comparing earlier research with observations made within this study (Yin, 2003; Silverman, 2000).

3.2 Data

This paper used data collected in Estonia, an EU member country known for its business excellence. The business environment is transparent (World Bank, 2016), economic freedom is well-respected (Heritage Foundation, 2016), and the talent pool available is outperforming many European and world economies (World Economic Forum, 2016; OECD, 2014).

The country has been named a European alternative to Silicon Valley (Giang, 2014) due to its advanced digital solutions (e.g., e-residency, e-government) and past history of global success stories that started there (e.g., Skype, GrabCAD, and Fortumo). Thus, Estonia represents a well-suited target for studies on absorptive capacity. Due to similarities in indices, the results of the studies performed in Estonia are believed to be generalisable to economies such as Singapore and Hong Kong (Feldmann and Sally, 2002), several Northern and Eastern European areas, as well as start-up areas including the Silicon Valley (USA).

3.3 Sample description

Qualitative sampling is significantly different from quantitative sampling (Yin, 2003; Silverman, 2000). A purposeful-sampling technique was chosen to collect interview data for this research, focusing on profit-seeking companies registered and operating in Estonia.

The number of companies participating in this research reached 61, with 62 semi-structured interviews conducted. The interview frame was prepared and extensively tested [Yin, (2003), p.57] by the research team. The interviews were conducted in Estonian, English, and Russian (widely-used business languages in the country of study). The interviewees were mainly owners actively involved in business (10%) or top managers of the companies (39%), followed by middle line managers (44%) and specialists (6%). For 2% of the respondents, the position within the company was not identified. The interviews lasted for 0.51.5 hours; the difference in times can be explained by the semi-structured nature and open-ended questions of the interview. The interview frame was followed loosely, allowing the participants of the study to develop their line of reasoning and provide as much information as possible. All the interviews were

transcribed in accordance with best practices (see, for example, Silverman, 2000), unfortunately, however, not always within a 24-hour timeframe (Eisenhardt, 1989).

Table 1 Sample by industrial sectors

Industry	*No. of companies*	*% of total*
Services	17	27.9%
Manufacturing	13	21.3%
Trade	10	16.4%
ICT	7	11.5%
Finance	5	8.2%
Other	9	14.8%
Total	*61*	*100%*

Table 2 Sample by type of respondents

Position	*No. of respondents*	*% of total*
Owners	6	10%
Top managers	24	39%
Middle managers	27	44%
Specialists	4	6%
Other	1	2%
Total	*61*	*100%*

Slightly over half the sample (54%) were controlled by local Estonian shareholders. The remaining part of the sample was represented by local subsidiaries of foreign companies. The division of the sample by size, based on the number of employees, was balanced: microfirms 8 (13%), small 16 (26%), medium 21 (35%) and large 16 (26%). The average number of employees for the sample was 198.

4 Results

The extensive data collected by a large-scale interview effort allows an extension of the knowledge regarding the processes and elements underpinning the concept of organisational absorptive capacity, revealing extensive and detailed information on the nature of the building blocks of organisational absorptive capacity as well as on the interconnections between them.

Generally, the companies had a positive attitude towards external information. The firms followed the trends set by others (including direct and indirect competitors) they constantly sourced information from outside, benchmarked themselves against peers, and tried to catch up if gaps were observed. Some authors (DiMaggio and Powell, 1983; Lieberman and Asaba, 2006) have attributed this behaviour to companies that feel uncertain and therefore follow the practices of others. Imitation is widespread and happens incredibly fast. However, not everything can be imitated: companies also show a tendency to develop inimitable resources in search of competitive advantage (Barney,

1991). The path-dependent and idiosyncratic nature of certain resources also limits the possibilities for imitation (Teece et al., 1997; Eisenhardt and Martin, 2000).

It is interesting to note that the Estonian companies studied benchmarked themselves mostly against global peers, even if they did not operate in the same markets. It has been shown that top companies also follow a similar approach, aiming to receive 1/3 to 1/2 of their ideas from external sources [Dahlander et al., (2016), p.282]. The companies studied also demonstrated intensive co-creation with clients, channelling clients' demands and ideas in to the company through employees (Crossan et al., 1999).

4.1 Continuing development

The major building blocks of the 'continuing development' dimension of absorptive capacity generally follow the framework proposed by Stulova and Rungi (2017), combining support of new-product development, continuous development of internal processes, support for employee learning, investment in technology, the importance of new trends for strategy development, and the search for knowledge-application opportunities. This study reveals considerable differences across elements and allows draws conclusions on firms' priorities.

The companies strived for ambidexterity, working on both internal and external aspects, as also recommended by Barge-Gil (2010, p.577). However, internal processes have been at the forefront of developments, somewhat outpacing product-related endeavours. Although most of the companies studied demonstrated positive developments within the several-years period prior to the study, this inward focus might be risky in the long run in scenarios involving a small market size and environmental pressures [Barge-Gil, (2010), pp.580, 581, 597].

> "We have invested all profits into new equipment and (.) working and rest conditions of our employees." (Company 10, regarding regular investments into new machinery and the working conditions of employees)

> "Speaking about those tests, they occur twice a year, and are individual, lasting up to 20 minutes… In addition, the manager reviews the number of works in the programme on a daily basis and sometimes checks how the employees service the customers based on the video recordings." (Company 24, regarding internal quality control for employees: twice a year they are tested; video surveillance is also used)

> "…if three years ago all units were dealing with their suppliers separately, despite being one group; then today, today we have a supply manager. (.) In monetary terms it is definitely a big gain." (Company 4, regarding centralization of purchases: a new position was created for this, leading to a considerable financial gain for the company)

The competitive situation is considered the main driver of both recent and current developments and also the main goal of companies' short to medium-term strategy. As suggested in earlier literature (Crossan et al., 1999; Walter et al., 2016), the developments are heavily client-driven: instead of proposing revolutionary products and services, the companies try to address existing clients' demands and create products and services that would be immediately in demand.

The companies followed the trends set by others, some observing direct and indirect competitors for inspiration, taking on board ideas for new product development. Some,

on the contrary, use pure imitation to minimise the first-mover advantage potential of others.

> "…new trends, new tastes, what happens in the world; then we also pretty much follow what is happening in the US, in Europe, those trends and then we make so-called 'tomorrow' in Estonia, but others [do it] half a year later." (Company 29, regarding following external trends)

> "…it is a little bit like copy your dirty tricks, would say about it. It is like if something works and is good or not, and does not go under idea stealing, if there is no ethical issue or so, then why not." (Company 23, regarding imitating others)

The client-reliance of new product/service development could be a result of the relative importance of service-oriented companies in the sample as well as for the Estonian economy in general; this could also be the main reason for product innovation lagging behind process innovation in general. Prevailing process innovation would imply that a dominant product design has emerged, leading to process standardisation, i.e., Utterback and Abernathy's (1975) segmentation stage. This situation is common for service companies, who mainly only introduce new services once they see a demand for them. However, the same tendency was also demonstrated by manufacturing and trade companies: instead of trying to offer products that would re-shape client preferences, they derived new products based on observed client behaviour or communicated client needs. It is worth noting, however, that client-reliance has also been found to influence re-shaping new-product/service development (Keeley et al., 2013).

> "About a year ago, or year and a half, I would answer, that it is a stupid question (laughs). (.) But actually, such suppliers do exist (.), who are really committed to helping you do well and they offer good and innovative solutions on their own." (Company 10, regarding client/supplier reliance)

Observations were made regarding product/service developments that were unique to multinational companies, i.e., where the owner of the Estonian company is a foreign firm. The results demonstrated that the companies that are part of a multinational corporation do almost no product/service development, with innovation occurring within the parent company, following analysis, R&D, and testing performed in other markets, and using local resources for manufacturing only. Even though addressing the local context through a local subsidiary is considered beneficial, the theory argues that subsidiaries should take on bigger role when they are financially secure (for example, by being more profitable than the headquarters), control resources, and have valuable local connections and headquarters in a small country [Ghoshal and Bartlett, (1990), pp.604, 607].

> "[Company 2] has (.) invested a lot into new technologies at a group level." (Company 2, regarding group-level development)

> "Well this I cannot really say that this innovation comes from the whole division, there is a dedicated group of people […]" (Company 49, regarding group-level development)

The analysis revealed that the firms acknowledge the importance of employees for corporate development, although employees' development and learning is mainly achieved through training programs. Some companies have formal rules on training quotas, some decide on an *ad hoc* basis, but in almost any situation the employee has to select the training desired as well as substantiate his/her choices, i.e., the actual support

for employee learning is a combination of the welcoming attitude of employer and the persuasion of employees, which contradicts the learning-organisation paradigm (Senge, 1990).

> "…we do offer, but when the employee asks for it or expresses interest towards some training. In general, I am of an opinion, that if the work is done, [a person] can attend a training. Work should not suffer." (Company 3, regarding employees having to show initiative to receive paid training, offered only if does not affect work performance)

> "The initiative is absolutely welcomed on a managerial level. We have a goal on a group level, that every manager should receive at least two trainings a year." (Company 4, regarding training quotas for managers)

Despite the general desire to develop the business, improve performance, and grow, the daily challenges of an increasingly dynamic environment reduce the capacity of companies to search for new opportunities. The growth realised seems to be based more on external developments that the companies were able to capture and utilise rather than the result of hard work and an internal search for ideas, i.e., the companies are adapting to the changing situation (Wang and Ahmed, 2007).

> "In Estonia the market is so small; there are very few clients who would be interested in our product and at some point the potentials just end. To keep those clients one should think of new hikes and entertainment, what they would be interested to try out." (Company 1, regarding facing environmental changes and search for new opportunities)

4.2 Bottom-up innovation

'Bottom-up innovation' occurs in the companies studied in a different manner than that described for technological giants such as Intel (Burgelman, 1983) or Google (Scott, 2008). The model of absorptive capacity proposed by Stulova and Rungi (2017) suggests that this element signifies the role of employees in recognising the value of trends, in generating new ideas, and in their ability to apply these ideas.

The analysis revealed that innovation achieved from within the company is mainly process-oriented. The employees took an active role in developing alternative solutions for existing processes (e.g., manufacturing, warehousing, and property management), with product innovation lagging behind. Being interpreted primarily as a constraint, process innovation can, however, also be of critical importance, even leading to product innovation [Datta et al., (2015), p.229].

> "In our firm new ideas are about making something in a new way, if the idea is reasonable, then we definitely implement it and this happens in 60% of cases." (Company 34, regarding bottom-up innovation)

Employees are usually not rewarded for their ideas, but process-related ideas result in improved efficiency in the workplaces, offering non-financial incentives for employees, without additional involvement and stimulation from the company side. Additional involvement in strategising is generally found to be important [Achtenhagen et al., (2013), p.437]. Managers should acquire both 'top-down and bottom-up knowledge flows' for good ambidextrous exploration and exploitation [Laureiro-Martinez et al., (2015), p.321]. However, there are also possible shortcomings, e.g., exploitation of bottom-up endeavours that is too expensive may lead to the company becoming

inward-focused [Jansen et al., (2005), p.1001]. Furthermore, incremental exploitation benefits exploration, while repetitive exploitation does not [Piao and Zajac, (2016), p.1431]. The bottom-up approach is also related with 'goal alignment', which may limit 'autonomous judgement' [Mom et al., (2015), p.813].

> "And we have (.) a large system of improvements and offers, where everyone can input data, irrespective of the working title and the language. So that you have an idea, [for example] there is a piece of equipment that you would like to fix (.). And once a month we select from those (.) the best idea, and reward not with money, but by providing benefits (.), like a SPA treatment with the family or some sort of a gift card." (Company 29, regarding financial rewarding bottom-up initiatives, rather exceptional in the companies studied)

> "Initiative is not rewarded at the moment (.), our employees are well-paid anyway (.). Let's say (.) an employee proposed an idea (.) we give him 1,000 Euro for its realization (.) and then after some time another employee proposes another idea (.) but does not get the money (.). Then there is dissatisfaction (.) and you cannot really speak about a friendly collaboration anymore." (Company 7, regarding not rewarding bottom-up initiatives)

With respect to products and services, employees are mainly expected to pass on information from clients (e.g., client feedback, new requests, and attitudes towards products and services). Employees are a source of vital knowledge, i.e., an input for further product/service development (Walter et al., 2016; Crossan et al., 1999). However, the decisions regarding product/service development, as well as the realisation of other ideas aimed at corporate advancement, are made by the top management or even owners of the organisations. Despite the importance of teamwork and flat hierarchies observed, which should encourage new ideas (Smid et al., 20015), decision-making was heavily centralised and a considerable amount of new developments emanated from the top management. It is easier for managers to accept, observe, and check the implementation of strategies they created; otherwise, they might not understand what has gone wrong [Lee and Puranam, (2016), p.1529].

> "…what the client really wants from us, this information we get from the client relationship manager, who works with the client, and in the system we have a dedicated place, where it's possible to write, that there is such a request, but don't have the product, then it goes immediately into implementation, if we don't have a mechanism, technology or something like that." (Company 8, regarding passing clients' information on, i.e., an IT system used to express new ideas that can be based on client requests)

> "The ideas come from the management mainly, or from the top level employees (.), from more experienced workers." (Company 13, regarding the prevalence of top-down and incumbent innovation)

> "We have (.) weekly brainstorming sessions, where you get an insight into what others are doing, what is going on in the world, think about some new things, it's like a sort of a constantly changing and constantly reacting to the environment. (.) [Then] I decide whether we do it or not." (Company 27, regarding the mix of bottom-up and top-down decision-making)

None of the companies said that they do not encourage bottom-up innovation or that they are not interested in employees' ideas. However, many of them complained that employees do not assume responsibility and do not offer any ideas. Still, given that the decision-making is centralised, the actual opportunities for employees to generate ideas are limited, discouraging the effort to do so. This is in line with earlier research:

employees will generate ideas only if they participate in the decision-making (Jansen et al., 2005).

> "Yes, we offer (.) some compensation. […] can come up with ideas how we can save money or how we can develop a product and then we normally give a little bit [money]. […] [It happens] too seldom." (Company 59, regarding employees not showing initiative)

The product/service development part of 'bottom-up innovation' matches that described for the 'continuing development' subset. Most of the development is incremental, client or environment-driven, with employees conveying important knowledge to support new-product development, making little or no attempt to revolutionise the industry.

4.3 Trust-based internal collaboration

As expected, 'trust-based internal collaboration' concerns people and collaboration, with need for the exchange of information, cooperation, and trust between people (Stulova and Rungi, 2017). The results demonstrated that this collaboration is mainly achieved through participation in meetings as well as by informal communication between employees, i.e., talking.

> "[Regularly] being done, discuss often. We have sales meetings every week, where we discuss the incoming (.) received offers or bottlenecks." (Company 13, regarding regularity of communication)

> "…to a large extent via internet (.) via skype, e-mail (.), however possible." (Company 7, regarding modes for the daily exchange of information)

> "The main information channel for us is an e-mail, then we also have internal web or intranet, where we have important information and news. And then we also have those weekly information letters, which are also available here in intranet. … And the units have either weekly or bi-weekly meetings, where the divisions assimilate information." (Company 16, regarding the daily exchange of information and regular meetings)

Most of the companies in the sample, assimilate to most companies in Estonia, had very flat organisational structures, facilitating the easy exchange of ideas and information (Smid et al., 2005). The data revealed that cooperation between employees within departments, as well as across departments, is vital, i.e., the provision of a service or the quality of the final product depends on several people/departments and collaboration between them. Communication and joint actions take place on a daily basis, implying that, for successful outcomes, employees must trust one another. Trust is good for cooperation, but simultaneously 'increase(s) the redundancy of information' [Jansen et al., (2005), p.1003]. Another important element emphasised by the respondents was a two-way direction of communication and cooperation, signifying that participation in collaboration is in the best interests of every employee. Two-way communication also improves how employees understand things and facilitates connectedness between people (Jansen et al., 2005). The voluntary nature of the cooperation is the most beneficial structure for firms to consider [Martin and Eisenhardt, (2010), p.278].

> "We are 25 people and everyone is like a top notch person, so … I am sort of proud of it or really satisfied that we have a nice company here." (Company 23, regarding internal relations)

> "…they are very friendly and just like family. Not like workers […]" (Company 59, regarding internal relations)

> "We have such organizational structure, that the chain of command is not too long. There are no in-between managers, middle managers and top managers. (.) But our communication is really free, luckily don't really have those who would speak behind the back and would not dare to say to face." (Company 27, regarding flat structure and its impact on communication)

Even though the results demonstrated a working pattern of cooperation and the ease and regularity of information flows, there were still problems regarding relations between people. The problems, however, were mainly emotion-driven and sometimes were not even related to situations within the working environment. However, since people can be affected by emotions, these emotions can exercise a negative influence on cooperation. The cases analysed did not find any situation in which emotions would deteriorate the cooperation performance within the company, although it still remains a theoretical risk, as suggested by the interviewees.

> "I think that absence of this trustful relationship is more on an individual level. (.) If some people just don't trust each other for some reason or there are some individual conflicts." (Company 16, regarding emotions at the individual level)

Feedback surveys and feedback sessions were widely used to gather feedback from employees, aiming to achieve constant improvements in the internal environment. The surveys were mostly anonymous and employees could communicate both their ideas and complaints, which presumably fosters trust within an organisation. The importance of trust and anonymity was highlighted in the study, together with other factors, including careful preparation (see also Waldman et al., 1998).

> "We think about employees' satisfaction (.) those three topics that get the worst feedback and then work on it. (.) We have satisfaction reviews twice a year, questionnaires, then we analyse, what are the results, we can see them per division, age group, gender. (.) The answers are anonymous." (Company 54, regarding regular anonymous feedback)

> "We conduct satisfaction studies every year and the results have been rather good. (.) We value mostly (.) satisfaction and then on another side, employee commitment." (Company 16, regarding regular feedback)

The companies with more active information exchange and cooperation between people demonstrated better results in the 'bottom-up innovation' dimension, supporting the overall role of people in corporate development and growth, as well as demonstrating the interrelations between different elements of absorptive capacity.

> "…trustful relationship is needed and I believe, we have it." (Company 16, regarding the importance of trust)

> "Such situation cannot really happen in our company, working alone is basically impossible." (Company 1, regarding the importance of trust and collaboration)

4.4 Deferred knowledge use

'Deferred knowledge use' is heavily related to internal processes within companies, as the archiving of knowledge, as well as its further re-appraisal, are parts of internal procedures, given that learning is cumulative (Kim and Inkpen, 2005). Stulova and Rungi

(2017) suggested that the companies should maintain valuable knowledge over time, making the deferred use of knowledge possible and viable. The data collected revealed significant differences across the sample studied.

> "Well for the new product development this information storage is rather large (.) those choices what model and what colour and what shape and to what sector is reasonable to add to the collection that is based largely to the data that we see in our client relationship database, what models become popular in what segment." (Company 30, regarding deferred knowledge use)

There were considerable differences in terms of the information stored. While, in general, R&D and product-development-repository activities are beneficial for absorptive capacity (Spithoven et al., 2011), many respondents interpreted deferred use in the narrowest way, referring to data maintenance as prescribed by the law (e.g., accounting documents, contracts, etc.). Manufacturing companies tended to preserve material on product quality to minimise the risks of reclamations in the future as well as to facilitate data analysis (Walter et al., 2016). In addition, organisations tended to store business analytics and performance indicators. Those were the materials mostly referred to with respect to deferred knowledge used and these could also be accessed and used at a later stage, for performance appraisals and forecasting.

> "A lot comes from the regulations, meaning have to maintain documents." (Company 5, regarding legal archiving requirements)

> "This is regulated by legal requirements, what concerns financial documents; archiving related to the core business of the firm allows to offer better service and (.) grants an overview of the history about what has happened on the real estate market. Plus archiving real estate appraisals is (.) really important because those could be asked even years later, for example, for the court investigations." (Company 17, regarding legal and industry-specific archiving requirements)

> "Well, a certain rule is that everything that is brought here, we archive. (.) We never throw away clients' files!" (Company 3, regarding keeping clients' information)

Even though some organisations have IT platforms for idea preservation and monitoring pending ideas and projects, it still seems that most of the know-how remains in people's heads, i.e., individuals' knowledge is not being codified into the shared knowledge base of the organisation. Some of the companies had a practice of knowledge sharing, whereby an employee who has attended training would then present the information to his/her colleagues, in line with the ideology of communities of practice (Hemmasi and Csanda, 2009). In cases involving a working community of practice, the individual knowledge could be conveyed to the organisational level, helping both to retain valuable knowledge over time (Nonaka, 1994) and to analyse it (Walter et al., 2016).

> "We have one room where half is shelves from the floor to the ceiling, where by years [documents are stored]. (.) At some point we have to destroy them, when the [prescribed by law] years have passed. (.) Mostly there are invoices received and issued. Well this is not the case that from archive would find some useful information. As I said, this useful information has to be kept all the time on the surface, not in archive." (Company 20, regarding important information being largely intangible)

The possibilities for the delayed use of ideas were demonstrated by the people interviewed. None of the firms studied had a routine procedure for re-appraisal of earlier knowledge, stressing that old knowledge becomes obsolete fast (Hedberg, 1981). Thus, unless the people in the company remain there, the real opportunities for the use of previously generated knowledge are minimal, especially given the general psychological tendency for undervaluing the benefits of older ideas, as evidenced in several interviews. Perhaps the relative inability to reactivate earlier knowledge is determined by the speed of environmental change. Deferred knowledge use is sometimes seen as constraint in innovation [Jansen et al., (2005), p.1002], especially if environment is changing quickly. Several companies stated that older ideas cannot be of real value due to the dynamics of the environment. This could also be an influence on the channels for new ideas since the companies' main strategy involved keeping up with the competitive situation, with internal idea generation and product development being somewhat disregarded.

> "What concerns product quality then naturally, because (.) because have to be able to prove 20 years later, that this product that we shipped out from here was in correspondence to the quality norms (.) so this is valuable." (Company 2, regarding the use of old information for legal and quality reasons).

5 Discussions

The aim of this research was to explore a model of absorptive capacity recently proposed by Stulova and Rungi (2017). A large-scale, interview-based study, based on data gathered from 61 companies in Estonia was carried out better to understand the mechanisms of absorptive capacity and their subsets. The results are summarised in Table 3.

While generally confirming the elements suggested by the model, the study has revealed some interesting peculiarities. For example, the companies' recent development has been driven by process improvements rather than by product advancements. The product/service development, in turn, has been considerably influenced by clients, i.e., the companies want to capture the clients' expectations, moving towards co-creation with clients and suppliers.

In general, the business environment is highly advantageous in Estonia, with favourable taxes and transparent procedures. On the negative side, companies tend to be limited by a small regional market, but this holds true only for companies that are oriented to the internal market. Another important aspect is the regulatory framework; its changes are a considerable source of volatility for companies.

The key findings of this study provide new information about the mechanisms of absorptive capacity. First, the interviews revealed usage of mainly three information sources for development: its clients; its headquarters; and international competitors. Client-orientation is the most peculiar and controversial; although logical in its nature at first glance; it is also known that companies may fail while following client opinion 'too carefully' [Christensen and Bower, (1996), pp.197–205]. Clients usually tend to provide evolutionary approaches – extensions and modifications of existing products and services – rather than revolutionary ones.

The second source of new developments is the company's headquarters; valid for those companies that are subsidiaries of multinational corporations. Subsidiaries are often used as resellers of products without having resources for knowledge-intensive

developments, which holds true for part of the sample studied. In these situations, new knowledge, sourced from the parent company, is absorbed without any additional transformation.

The third used approach – imitation – has long been widely studied and relates to the adaptive capability of the firm (Wang and Ahmed, 2007). The initial reasons for this emanate from mature countries in which industries are becoming homogenised due to innovation followers copying the best innovators (DiMaggio and Powell, 1983), but this cannot be the case for the sample studied due to the relatively short history of capitalism and considerable growth rates achieved in Estonia. High environmental turbulence is also known to reduce imitation (Helfat et al., 2007) by not allowing companies to draw clear conclusions on what would be the best strategy for Estonian companies. Many companies emphasised differentiation as a factor in reducing imitation: in cases where the product or the service offered was not a commodity, the companies tried to make their offering unique, thereby reducing competitive pressures.

Table 3 Main characteristics of the absorptive capacity elements

Element	*Stulova and Rungi (2017)*	*Results*
Continuing development	Support employee learning	Trainings seen as the main vehicle for employee learning: encouraged, but requires employee initiative
	New trends important for strategy	Internal and external information sources perceived equally well
		Information sourced globally, rather than regionally
		Extensive mirroring of others' actions, not only of direct competitors, but also of indirect competitors or those in different geographical regions
	Support new product/service development	Most of the developments were client-driven
		Special situations for manufacturing subsidiaries of multinationals: all developments were external to the company
	Improve internal processes	Inward focus, most of the recent development occurred in terms of processes
	Improve technological solutions	Limited
	Constant search for knowledge application	Limited
Bottom-up innovation	Employees recognise value of new trends	Employees were expected to pass on information from clients
	Employees generate ideas	Employees' ideas mainly process-oriented (focused on existing solutions or having inward focus)
		No significant bottom-up ideas, incremental changes
		Rather top-down
		Formal incentive systems for idea generation were not widespread
	Employees' ideas are applied	Ideas were applied, if so decided by the top management

Source: Based on Stulova and Rungi (2017)

Table 3 Main characteristics of the absorptive capacity elements (continued)

Element	*Stulova and Rungi (2017)*	*Results*
Trust-based internal cooperation	Exchange of information	Regular, often
		Informal communication widespread – facilitated by the flat organisational structures
		E-mails, meetings, newsletters
		Regular feedback sessions, two-way (also surveys)
	Cooperation	Cooperation and teamwork necessary for business
	Trust	Trust existed and was valued highly
		Somewhat undermined by human emotions if employees had conflicts
Deferred knowledge use	Maintain valuable knowledge	Mostly interpreted narrowly, i.e., as required by law (accounting data, business analytics)
		Maintained client data and performance indicators and reused of it for forecasting and analysis
		Most of the critical knowledge remained in people's heads
	Deferred use of knowledge possible	Possible, some limited used of IT tools for idea conservation
		Generally negative perception of older information and ideas: prevailing understanding that ideas expire fast
	Deferred application of knowledge	Not recorded

Source: Based on Stulova and Rungi (2017)

For all dimensions of absorptive capacity, organisational antecedents matter greatly. For example, flat organisational structures facilitate information exchange and collaboration, promoting new idea development and, thus, innovation (Bryant, 2003). They also encourage knowledge sharing and distribution, creating a suitable environment for the deferred use of knowledge. Knowledge aspects clearly add to the 'continuing development' subset; as well as benefiting from flat organisational structures, smaller companies with little hierarchy are more flexible, adapting to changes to meet the challenges of the environment (Walter et al., 2016; Crossan et al., 1999).

Environmental turbulence is another important influence on all subsets of absorptive capacity. It mainly affects the 'continuing development' subset as it introduces many challenges. However, it also is important for 'trust-based internal cooperation' and 'bottom-up innovation' as it provides employees (especially those who liaise with clients, suppliers, and partners) with opportunities to source new external knowledge and to convey it to the decision-makers within the organisation (Crossan et al., 1999). The only subset that has an inverse relationship with dynamism is 'deferred knowledge use'. Rapid changes quickly make information obsolete, discouraging the revisiting of old ideas (Hedberg, 1981).

6 Conclusions

The results are value-adding in several ways. First, they provide empirical elaboration of the recent model of absorptive capacity suggested by Stulova and Rungi (2017). Second, the results demonstrate the elements of absorptive capacity at a satisfactory level of detail, making visible the interconnections between the processes within it, as well as differentiating them based on their relative importance. Third, they confirm that environmental turbulence shapes the behaviour of firms, affecting all subsets of absorptive capacity. Finally, the results demonstrate that external information is of critical importance for companies as it shapes their strategic choices.

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Notes

1 (.) identifies a longer pause made by the interviewee. […] or … preceding text means that some part of the text has been omitted, making the text more concise. A verb within brackets identifies a side action, such as laughing or taking a call. Text in square brackets is our own addition, based on the whole text, to make the citation more readable, e.g., if the sentence on its own would not make sense.

Curriculum vitae

Personal data

Name:	Valeria Kiisk (Stulova)
Date of birth:	4 October 1985
Place of birth:	Tallinn, Estonia
Citizenship:	Estonian

Contact data

E-mail:	valeria.kiisk@gmail.com

Education

2013– 2020	Tallinn University of Technology – PhD
2011–2013	Tallinn University of Technology – MA
2004–2008	Stockholm School of Economics in Riga – BSc
1998–2004	Tallinn Russian Central Gymnasium – High school

Language competence

English	Fluent
Estonian	Fluent
Russian	Mother tongue

Professional employment

2009–…	Redgate Capital – partner, member of the board
2007-2009	United Partners – analyst
2006-2006	Evli Securities – analyst

Elulookirjeldus

Isikuandmed

Nimi:	Valeria Kiisk (Stulova)
Sünniaeg:	4. oktoober 1985
Sünnikoht:	Tallinn, Eesti
Kodakondsus:	Eesti

Kontaktandmed

E-post:	valeria.kiisk@gmail.com

Hariduskäik

2013–2020	Tallinna Tehnikaülikool – PhD
2011–2013	Tallinna Tehnikaülikool – MA
2004–2008	Stockholmi Kõrgem Majanduskool Riias – BSc
1998–2004	Tallinna Kesklinna Vene Gümnaasium – keskharidus

Keelteoskus

Inglise keel	kõrgtase
Eesti keel	kõrgtase
Vene keel	emakeel

Teenistuskäik

2009–…	Redgate Capital – partner, juhatuse liige
2007–2009	United Partners – analüütik
2006–2006	Evli Securities – analüütik