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*Advancing a Dynamic Model of Absorptive Capacity:
Which Organizational Antecedents Matter?*



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**ADVANCING A DYNAMIC MODEL OF ABSORPTIVE
CAPACITY: WHICH ORGANIZATIONAL
ANTECEDENTS MATTER?**

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ABSTRACT

Absorptive capacity is increasingly understood as a dynamic capability, following the recent theorizing of Zahra and George (2002). This reconceptualization, however, has failed to incorporate dynamics and to explain how absorptive capacity can promote renewal and organizational change. This paper addresses the issue of the dynamization of absorptive capacity by proposing a model which extends the organizational antecedents of absorptive capacity as to include both stable and dynamic dimensions. The dynamic dimension is set to comprise a number of organizational attributes related to knowledge diversity mechanisms and to the capability to adapt of firms (slack resources, tolerance for failure, willingness to cannibalize, and external openness). The paper concludes with practical implications, discussing the practices managers should follow in order to design organizations apt to breaking from capability-rigidity loops and thereby taking advantage of externally generated knowledge.

INTRODUCTION

Firms have become progressively more reliant on external sources of knowledge in order to achieve and sustain innovation (Von Hippel, 1988, Freeman, 1991, Lundvall, 1992, Powell et al., 1996). This organizational trend, supported by extensive empirical evidence (Hagerdoorn, 2002, Laursen and Salter, 2006), has been popularized as the ‘open innovation’ model (Chesbrough, 2003). Greater reliance on external parties implies that the *ability to identify and to exploit outside knowledge* while undertaking fundamental technological work has increasingly become a critical component of the innovative capabilities of a firm. This ability is theoretically linked to the concept of ‘absorptive capacity’ (Cohen and Levinthal, 1989, 1990), considered one of the most influential and employed constructs to emerge in the literature in recent decades (Lane et al., 2006). This is because absorptive capacity has been found to be a key driver of the competitive advantage of a firm, mediating important organizational outcomes such as innovation and performance (Escribano et al., 2009).

Due to these consistent positive results, research on absorptive capacity has been very prolific since Cohen and Levinthal’s (1990) seminal work. It has nonetheless changed focus in the last 7-10 years. Following the extensive application of the construct as a static resource (i.e. as equal to R&D expenditures) which dominated the nineties, the focus of attention in the end of that decade shifted back to where the field began, i.e. the learning and related knowledge-base processes. The paper that shaped the current direction of the field is “Absorptive Capacity: A Review, Reconceptualization, and Extension” by Zahra and George (2002). In what has been considered one of the most important contributions of recent years (Lane et al., 2006, Volberda et al., 2010), Zahra and George (2002) proposed a reconceptualization of ‘absorptive capacity’, suggesting that it should be seen as “a dynamic capability pertaining to knowledge creation and utilization that enhances a firm’s ability to gain and sustain a competitive advantage” (p.185). This approach has been followed by much of posterior work (i.e. Fosfuri and Tribó, 2008, Lichtenthaler, 2009), indicating a growing tendency to view absorptive capacity as a capability rather than a structural part of the firm. The acceptance of this approach offered new insights to work in the field. First, the view of absorptive capacity as a set of organizational routines and processes (and no longer as a given ‘thing’) meant that it became subject to change through managerial action. Consequently, the focus of the analysis shifted to the structure, policies and processes within an organization that affect knowledge creation, appropriation and application. Secondly, a capability-based understanding facilitated the analysis of the components, antecedents and outcomes of the construct (Jansen et al., 2005).

However, despite these advantages, an important inconsistency permeates the reconceptualization of Zahra and George (2002). The notion of ‘dynamics’ is introduced on the one hand – conferring the character of change to the concept – while path-dependency is emphasised on the other. Although the authors outline the internal triggers to absorptive capacity (i.e. social integration mechanisms), they do not specify the triggers or foundations of dynamics. It is as if absorptive capacity is responsible both for self-reinforcing specialization patterns (due to its cumulative mode of development which eventually leads to lock-outs and cognitive traps) and for promoting (almost magically) the continuous renewal of organizational competences. This implicit tension is present in the work of Zahra and George (2002) and in much subsequent research (i.e. Todorova and Durisin, 2007, Lichtenthaler and Lichtenthaler, 2009) and can be related to the lack of clarity around the method of *dynamizing* capabilities (Schreyögg and Kliesch-Eberl, 2007). Further theoretical clarification in this point is crucial, given the important consequences it implies. A theory of absorptive capacity therefore needs a more elaborate framework, which takes us beyond the mere consideration of it as a manifestation of a dynamic capability.

Thus, in my point of view, the postulation of path-dependency and organizational inertia on one hand, and the dynamization of absorptive capacity on the other constitutes a serious theoretical ambiguity. It is important to emphasise that the popularity and attention recently received by the dynamic capabilities’ framework is very much related to its promise of offering a way out of path-dependencies and inertia (Arend and Bromiley, 2009), problems recurrently identified in the literature of the eighties and nineties as barriers for the strategic renewal of firms (Hill and Rothaermel, 2003). This postulation thus points to the following critical question. How can the two opposing forces of inertia and change coexist in the same construct? This paper aims to answer this question, addressing the issue of whether absorptive capacity can truly be conceived as a dynamic capability – and, if so, how? The contribution of the paper resides on the elaboration of a logically consistent model for incorporating dynamic properties into absorptive capacity. The model proposes that the organizational antecedents of absorptive capacity be extended to include both stable and dynamic dimensions (the so-called ‘adaptive capabilities’). The dynamic dimension is set to comprise a number of organizational attributes (i.e. slack resources, tolerance for failure, willingness to cannibalize, external openness) that drive organizational renewal, following a voluntaristic orientation that places emphasis on the proactive role of managers. Hence the model has important practical implications too. It specifies which managerial practices managers should follow in order to design internal organizations apt to break

from capability-rigidity loops and thereby to take advantage of externally generated knowledge.

This article is organised into five sections as follows. The following section starts by reviewing the literature on absorptive capacity in order to depict its theoretical background and application in past research. Next, section 3 addresses the issue of whether a dynamization of the concept is desirable and, if so, plausible. Section 4 outlines a solution to the problem of dynamization. Following an integrative approach, a framework which includes both stable and dynamic elements is proposed. The final section concludes the paper, discussing implications for research and practice.

ABSORPTIVE CAPACITY: PAST RESEARCH

The Origins of The Absorptive Capacity Construct

Cohen and Levinthal (1989) initially coined the term ‘absorptive capacity’ in the management field as “the firm’s ability to identify, assimilate and exploit knowledge from the environment” (p. 569) to express the dual role of R&D activities. By dual role they meant that R&D served both for the creation of new knowledge (innovation) and for the ability of firms to absorb and deploy knowledge available externally (learning). Their basic argument was that firms invest in R&D not only to directly pursue innovations, but also to keep abreast with the latest research findings and developments in the industry, thereby gaining first-mover advantages in the deployment of new technologies. This is because, contrary to most economic models at the time, technological knowledge is not portrayed in their model as a public good which can be easily transferred or processed. Rather, they argued that firms must incur in long-run substantial costs (R&D efforts) in order to develop a stock of prior knowledge, which subsequently can allow them to absorb externally generated knowledge. In essence, what they sought to express was the fact that knowledge developed from outside can not be freely or effortlessly absorbed by a firm, even if available in the public domain (Escribano et al., 2009). Their early work put great emphasis on the role of the external environment (i.e. exogenous variables) in determining absorptive capacity, given the initial aim to explain a firm’s incentives to invest in R&D (and consequently, in absorptive capacity). Following these lines of reasoning, variables such as the scope of technological

opportunities, the propensity of knowledge spillovers and the industry demand were identified as key drivers of absorptive capacity.

Path-Dependency and Absorptive Capacity

From its very conception, absorptive capacity was said to develop cumulatively and in a path-dependent fashion (analogously to individual learning). Path-dependence is applied in the terms of Sydow et al. (2009: 696): “as a rigidified, potentially inefficient action pattern built up by the unintended consequences of former decisions and positive feedback processes”. Cohen and Levinthal (1990) were assertive in stating that history matters, as they viewed the ability to evaluate, understand, acquire and consequently apply new knowledge to be dependable on a firm’s past experiences in relevant knowledge domains. They actually dedicated an entire section of the 1990 paper to argue for a powerful force of path-dependency inherent to absorptive capacity, almost as if it was definitive. Their basic claim, that “prior knowledge permits the assimilation and exploitation of new knowledge” (p.136), had a very deterministic connotation. It suggested the formation of restrictive specialization patterns, which increasingly reinforced the predisposition of firms to work in particular domains and that eventually lead to irreversible states of total inflexibility or confinement. As a consequence, they expected lock-outs to emerge, arguing that some strategic alternatives would become unachievable for firms that did not build absorptive capacity at initial stages. In line with Nelson and Winter’s (1982) reasoning, they suggested that inertia facilitated routine-based learning, and, similarly, ‘local search’ (Rosenkopf and Nerkar, 2001). In their own words: “the cumulative quality of absorptive capacity tends to confine firms to operating in a particular technological domain” (Cohen and Levinthal, 1990: 137).

Overall, the message that was carried out from Cohen and Levinthal’s work and replicated extensively later on was the notion that prior related knowledge is needed for the assimilation and application of new outside knowledge. In view of that, the development of absorptive capacity has been seen as a *by-product* of the R&D activities undertaken by a firm, that is, as a development that takes place in a more or less passive way, moulded by the fingerprints of a firm’s past practices. The traditional (and by far overriding) perspective is that absorptive capacity follows “an unidirectional and patterned developmental path” (Zahra and George, 2002: 198). As Zhang et al. (2007: 515) have expressed it, “it is commonly thought that absorptive capacity is the result of cumulative path-dependent R&D efforts by the firm”. As a consequence, absorptive capacity has been dominantly seen as a driver of inertia within organizations (Hill and

Rothaermel, 2003). This conviction, found nearly in all research either explicitly or implicitly, remained unchallenged until recently, when new theorizing has sought to re-emphasize the learning and the process perspective of the construct.

Reconceptualization

In trying to tackle the oversimplification of the concept of ‘absorptive capacity’ as a static resource, which prevailed in most studies during the nineties (resulting in a great deal of ambiguity and inconsistency in the literature) (Lane et al., 2006), Zahra and George (2002) offered a reconceptualization of the construct. As noted previously, they proposed the view of absorptive capacity as a manifestation of ‘dynamic capability’ (Teece et al., 1997, Helfat and Peteraf, 2009) which could be disaggregated in the two subsets of potential and realized absorptive capacity. While ‘Potential Absorptive Capacity’ was set to comprise the initial processes involving acquisition and assimilation of new, external knowledge, ‘Realized Absorptive Capacity’ referred to the capabilities of transforming and exploiting it.

In fact, their work has been considered a major refinement in the theory, having provided the grounds to much of the subsequent investigations¹ (i.e. Jansen et al., 2005, Lane et al., 2006, Fosfuri and Tribó, 2008, Vega-Jurado et al., 2008, Lichtenthaler, 2009, Escribano et al., 2009, Lichtenthaler and Lichtenthaler, 2009, Volberda et al., 2010). The consequences of their proposal cannot be underestimated. Adopting Zahra and George’s approach implicated that absorptive capacity should be viewed as embedded in the organizational processes and structures of a firm (and not only in R&D-related investments) and, as such, as an element of the organization that can be directly controlled and managed. More importantly, it meant that absorptive capacity should be seen as part of a class of capabilities – the *dynamic* ones – which are responsible for introducing change into an organization, enabling it “to reconfigure its resource base and to adapt to changing market conditions in order to achieve competitive advantage” (Zahra and George, 2002: 185). It should thus follow a “multidirectional and fluid path, rather than a patterned trajectory of knowledge acquisition and exploitation [...], in which the locus of search is continually redefined” (p. 185).

¹ According to the ISI Web of Science, as of 01/03/2010, 454 peer-reviewed papers have quoted the article of Zahra and George (2002)

The problem is that, although prescribing a departure from the prevailing view of absorptive capacity, Zahra and George (2002) did not explicate its microfoundations. Because their discussion lacks clarification of the theoretical and operational basis of the construct, the introduction of dynamics into it becomes rather ambiguous, raising doubts about the pertinence of their approach. The problem is amplified when they explicitly comply to the view that absorptive capacity is path-dependent. In other words, the question that remains unanswered in their paper is how can absorptive capacity secure the introduction of change and strategic renewal into organizations (i.e. be a dynamic capability), while at the same time be subject to the logic of path-dependency? Not even the review of Todorova and Durisin (2007), which critically assessed the paper, touched the topic, indicating that this discrepancy has not yet gained noticeable attention. The discussion of this issue is, however, highly important, given the widespread application of absorptive capacity and of Zahra and George's (2002) interpretation in particular.

The Three Complementary Learning Processes of Absorptive Capacity

Following this reconceptualization, Lane et al. (2006) proposed a more detailed process-based definition of absorptive capacity as a firm's ability to utilize externally held knowledge through three sequential processes of exploratory, transformative, and exploitative learning. Exploratory learning refers to assimilating and acquiring external knowledge through scanning activities. Exploitative learning relates to applying acquired knowledge for commercial outputs. Transformative learning links these two processes, and it refers to maintaining knowledge over time.

Adopting this definition is beneficial insofar as it clarifies and stresses the multiplexity of interrelated processes embedded in this complex concept, as well as helping to define the limits of research in the field. Although intrinsically inter-related, these processes call for distinct organizational resources and managerial capabilities and have in fact demonstrated to be empirically distinct (Lichtenthaler, 2009). For this reason, they have been treated as separate entities in the literature (expressed also in terms of the classic exploration vs. exploitation dilemma of March (1991)) and investigated in different streams of research. For instance, explorative learning is linked to the literature of 'organizational search process' (i.e. Katila and Ahuja, 2002, Laursen and Salter, 2006).

ABSORPTIVE CAPACITY AS A DYNAMIC CAPABILITY? ASSESSING A RECONCEPTUALIZATION

The review presented in the previous section indicates that there is an increasing tendency to view absorptive capacity as a capability, following the work of Zahra and George (2002) (Volberda et al., 2010). It has been pointed out, however, that this view is not free from incoherences and theoretical blindspots. It seems to rely on an overstretch of the concept, in which it is thought of as being purblind at certain times and as being fully flexible at others. Given this impasse, in this section I address the question of whether the introduction of a dynamic dimension to the concept is desirable in first place and, if so, plausible.

First of all, it should be noticed that “the term dynamic refers to the capacity to renew competencies” (Teece et al., 1997: 515). Even though critics have time and again pointed to the definitional problems around the dynamic capabilities view (Arend and Bromiley, 2009), it is hard to deny that, regardless of which label one chooses, it indisputably encompasses the character of *change*². In this literature, change is often referred to by terms such as realignment, reconfiguration, transformation, adaptation and renewal. As Helfat and Peteraf (2009: 97) characterize it: “dynamic capabilities rest on firm processes that can alter current positions, leading to an effect on firm performance and competitive advantage, as well as to positions and paths”. In the context of absorptive capacity, change is bound to reflect a development in the knowledge base of the firm. It is understood, more precisely, to express the *ability* to handle external knowledge that is not aligned to the current technological trajectory of a firm and therefore loosely related to its existing knowledge base. Change in absorptive capacity is thus thought to refer to a break from previous learning courses.

In light of this perspective, I argue that the dynamization of absorptive capacity is desirable. A conceptualization that brings change to the forefront of the research in the field is indeed beneficial. It would be misleading to consider absorptive capacity as a totally passive entity which can be neither manipulated nor altered. Not only the theoretical, but also the empirical arguments are persuasive in this regard. It is known from empirical evidence that some firms

² In this paper I follow the conceptualization of Helfat et al. (2007), according to which dynamic capability is the ability of an organization “to purposefully create, extend or modify its resource base” (p.1). The concept includes three functions: the ability to identify the need or opportunity to change; to formulate a response and to implement a course of action. For a recent and detailed review of research on the topic, I refer to Helfat and Peteraf (2009).

are able to apply knowledge which belongs to dissimilar technological fields, in principle distant to their knowledge base. Studies such as Cattani's (2006) reveal that firms eventually initiate new technological trajectories and are able to organically diversify their knowledge base.

The example of the Danish company Sonion (formally Microtronic and now part of Pulse) provides an interesting illustration in this regard. Initially a producer of electroacoustical and electromechanical products such as volume controls and speakers, Sonion moved into MEMS technology (MicroElectroMechanical Systems) in the late nineties. This move resulted in the world's smallest silicon microphone for mobile phone and hearing aid applications, launched in the market in 2005. Interestingly, the companies' competencies were originally anchored on mechanics and on manual assembly principles which did not include integrated circuits, and hence were very different from the clean room facilities and computer simulation tools needed for MEMS technology. For this reason, a break from path-driven learning patterns undeniably had to take place to allow such a process of competency-development. Another well-documented example in the literature is IBM, a company that first transformed itself from an electromechanical accounting equipment company into an electronic computing company (1940s-1960s) and, later (2000s), from a hardware-based computing company into a computing services company (Agarwal and Helfat, 2009). Of course these are extreme cases of organizational renewal which, one could argue, hardly ever occur. Yet the point is, the concept of absorptive capacity should be able to incorporate and handle the class of phenomena described in these examples.

However, as it stands at the moment, the plausibility of the theory as quite problematic. As discussed earlier, the micro foundations of change need to be explicated in order to preserve the theoretical coherence of the model. The mechanisms of dynamization of absorptive capacity (and of capabilities in general) are far from clear (Schreyögg and Kliesch-Eberl, 2007). Because paths, positions and processes are aspects that lie at the heart of the capability conception (Teece et al., 1997)³, and contain inherent traces of rigidity, it is not obvious where change is supposed to originate or where the seeds of flexibility can be tracked down. We need a better understanding of how organizations can gain and maintain flexibility to avoid becoming inert or locked-in. Recent

³ The concept of capacity relates to the notion of organizational resource and includes tangible and intangible assets that an organization can be put into use for producing an outcome. Capabilities can be seen as embedded in the dynamic interaction of multiple knowledge sources, being firm-specific and thus less transferable ones. Therefore, organizational capabilities are conceived as high-level routines or bundles of specific routines (Grant, 1991).

scholarship has called for further work on the micro-foundations to address this gap (Felin and Foss, 2005, Rothaermel and Hess, 2007, Volberda et al., 2010).

In sum, the suggestion of including a dynamic dimension to the concept seems not only desirable, but also imperative, given the context of changing market and technological conditions and of compelling empirical evidence. Environmental pressures to reactively overcome rigidities and inertia and to proactively shape uncertain environments are likely to increase in importance. For this reason, issues of strategic renewal must certainly be covered by the concept. Furthermore, this perspective is very much in accordance with the seminal work of Cohen and Levinthal (1989, 1990), who emphasized the learning processes underlying absorptive capacity.

HOW TO INCLUDE THE MISSING FLEXIBILITY: ADVANCING A DYNAMIC MODEL OF ABSORPTIVE CAPACITY

In reaction to this point, in this section I suggest a solution to the problem of dynamization of absorptive capacity. Having accepted the plausibility of this effort, I attempt to elaborate a framework which extends the organizational antecedents of absorptive capacity and which accommodates the countervailing logics of accumulation and change.

Before discussing the framework in detail, it is important to note that the key to the inclusion of a dynamic feature is the recognition that absorptive capacity does not solely depend upon the existing stock of knowledge of the firm (or the nature of external knowledge), but also upon managerial choices relating to architectural design and to allocation of resources (van den Bosch et al., 1999). The starting point of any advanced absorptive capacity thought is the analysis of its organizational antecedents. That is to say, whether and how well, a new technology will be incorporated into the existing technological practice of a firm will depend upon its existing knowledge base and upon the organizational processes that enable the development of new competences and the exploration of novel ways of integrating new and old technologies. This qualification is crucial, insofar as the view of absorptive capacity as equal to prior knowledge is still pervasive (or even dominant) in the literature (Lane et al., 2006, Zhang et al., 2007).

Organizational Antecedents of Absorptive Capacity

The contribution of van den Bosch et al. (1999) is crucial in this matter. These authors worked on the identification of the organizational determinants of absorptive capacity and proposed organizational forms and combinative capabilities to be its key elements. Whereas organizational forms address the overall structure of an organization, combinative capabilities refer to the "capability to synthesise and apply current and acquired knowledge". This term, originally coined by Kogut and Zander (1992), was first applied by van den Bosch (1999) to conceptualize and define the organizational determinants of absorptive capacity. In short, combinative capabilities are set to comprise the mechanisms that enhance interaction among employees and thereby the internal exchange of knowledge, be it explicit or tacit.

Three types of combinative capabilities have been identified: (1) coordination capabilities, (2) systems capabilities, and (3) socialization capabilities. Coordination capabilities refer to lateral methods of coordination between members of an organization and which involve cross-functional interfaces, participation in decision-making and job rotation. System capabilities, in turn, are understood in terms of directions, procedures and manuals that are used to integrate explicit knowledge. They encompass the two dimensions of formalization (the degree to which rules, procedures and instructions are formalized and written down) and of routinisation. Finally, socialization capabilities relate to the ability of a firm to produce a shared ideology that offers members collective interpretations of reality, in which there exists a high degree of shared values, beliefs, a common language and guidelines for appropriate behavior. Two mechanisms were associated with socialization capabilities: connectedness and socialization tactics. Connectedness refers to the density of social linkages among employees, while socialization tactics are instruments that provide shared socialization experiences (van den Bosch et al., 1999).

All in all, these antecedents share the fact that they all convey to the internal processes of dissemination and integration of knowledge (the so-called internal sphere of absorptive capacity). As expressed by Cohen and Levinthal, (1990: 131) "an organization's absorptive capacity does not simply depend on the organization's direct interface with the external environment, [but] it also depends on the transfers of knowledge across and within sub-units that may be quite removed from the original point of entry". Subsequent work on antecedents (Jansen et al., 2007, Fosfuri and Tribó, 2008, Vega-Jurado et al., 2008) applied basically the same framework put forward by van den Bosch

(1999). Together these studies shifted attention toward the role of internal antecedents in explaining the development of absorptive capacity, suggesting that the conventional explanatory variable (R&D expenditure) needed to be complemented by the investigation of a broader range of organizational mechanisms. While being crucial contributions, they nevertheless comply with the view that absorptive capacity is developed largely through the accumulation of related knowledge that permits the evaluation and utilization of subsequent developments within a field and, therefore, they lack dynamics. As expressed by Volverda et al. (2010: 6), “not only limitations in a firm’s current base, but also the rigidity of organizational forms and the combinative capabilities to synthesize and apply current and acquired knowledge may generate inertia in adapting AC [absorptive capacity]”. The contribution of this paper is precisely to elaborate on the mechanisms that can trigger change into absorptive capacity.

The Framework

In accordance with this line of research, absorptive capacity in the present paper is conceived as a joint outcome of developments in the knowledge environment and of managerial actions. I therefore propose a framework in which prior knowledge, organizational structure and combinative capabilities are supplemented by an additional dimension, adaptive capabilities⁴. That is, absorptive capacity is set to be determined by i) prior knowledge (both market and technology- related) (Cohen and Levinthal, 1990, Lichtenthaler, 2009) and by a set of organizational antecedents defined as ii) organizational structure (van den Bosch et al., 1999, Zhang et al., 2007); iii) combinative capabilities (van den Bosch et al., 1999, Jansen et al., 2005) and iv) adaptive capabilities. Figure 1 depicts the proposed framework with all the determinants of absorptive capacity. Note that it further presents its outcomes, namely innovation and performance. They are depicted in the model (although not further discussed) in order to underline the point that absorptive capacity is not a goal in itself, but that it moderates important organizational results.

⁴ The term ‘adaptive’ has a different connotation of the one traditionally used in the marketing and strategic literature, in which it is defined “as the ability to identify and capitalize on emerging market opportunities” (Oktemgil and Greenley, 1997).

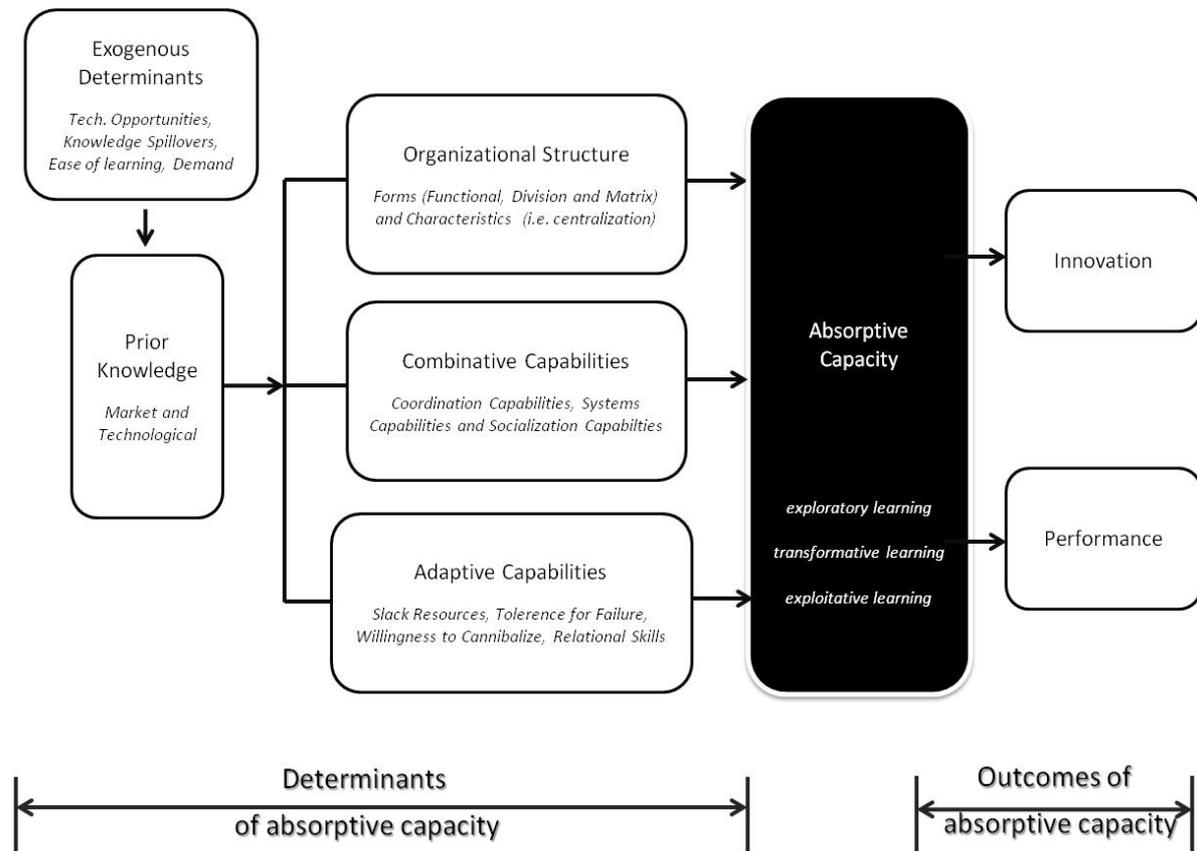


Figure 1: Toward a General Model: Antecedents and Outcomes of Absorptive Capacity

Source: Author's elaboration based on Cohen and Levinthal (1990), van den Bosch (1999), Lane et al. (2006) and Lichtenthaler (2009)

In a nutshell, the contribution of this framework is to add a new set of capabilities – the ‘adaptive capabilities’ – defined as *the ability to build new competences which will support the application and incorporation of new knowledge*. They refer to mechanisms that promote the development of new resources and that thereby expand (or destroy) the constellation of the competencies of an organization. By new resources I specifically mean those related to the development of new technological competencies, such as new production facilities and operations, engineering skills and technological expertise in new fields, as well as knowledge about other types of production processes (Danneels, 2008). Because new knowledge is localized not only *organizationally* (external as opposed to internal to the firm), but also *technologically*, in the sense that it can be similar or distant to the existing technological domain of the firm (Rosenkopf and Nerkar, 2001), externally assimilated knowledge may guide capability development in order to be

implemented (i.e. there might exist a strategic knowledge gap) (Helfat et al., 2007). As Huston and Sakkab (2006) observed, ideas from outside are hardly ever ready to be marketable, as they normally require development. In this way, adaptive capabilities can be interpreted as *practices that support or facilitate knowledge diversity within the organization*. They depict the ability of firms to move quickly to new opportunities, to adjust to markets and thereby to avoid conceit. In contrast, combinative capabilities are practices that promote knowledge sharing among a firm's employees (Maes, 2008). Since the utilization of new knowledge depends on the managerial practices firms put in place to select the various projects and the activities to invest in, as well as to determine how to allocate resources among them, adaptive capabilities are regarded as crucial for the building of absorptive capacity. They are introduced to suggest the notion of flexibility, a notion that purposefully contradicts the ideas of path-dependence and complacency strongly associated with absorptive capacity.

The basic logic is that if a firm lacks adaptive capabilities, the cycle of path-dependency and inertia will be reinforced. This is because the lack of adaptive capabilities precludes firms from exploring alternate sources of knowledge and thereby from grasping major shifts in the external environment. As a result, firms will tend to be confined to local searches, and therefore to applying knowledge closely related to the existing technological domain. This is understood as a more or less "routine activity", since incorporating proximate knowledge does not require changes in a firm's organizational structure and processes. As Cohen and Levinthal (1990) have described: "absorptive capacity is more likely to be developed and maintained as a byproduct of routine activity when the knowledge domain that the firm wishes to exploit is closely related to its current knowledge base. When, however, a firm wishes to acquire and use knowledge that is unrelated to its ongoing activity, then the firm must dedicate efforts exclusively to create absorptive capacity (i.e. absorptive capacity is not a byproduct)" (p.149). If, on the other hand, adaptive capabilities are present, the dynamic feature of absorptive capacity will be able to flourish in the sense that firms will be more apt to perceive and use new knowledge to some extent incompatible to their current knowledge base, to build new cognitive structures and to create new learning opportunities (i.e. coping with path-dependencies). In this way, adaptive capabilities impact the disposition of firms to explore and exploit knowledge in distant areas to its existing expertise. Because learning tends to be local (Rosenkopf and Nerkar, 2001), adaptive capabilities provide mechanisms to counter balance this bias. By channeling resources to activities that can lead to the diversification of a company's knowledge base, they facilitate the reduction of path-dependent dynamics. As a result, with the lack of

adaptive capabilities, absorptive capacity is curtailed, in the sense that it is not able to initiate processes of organizational renewal.

The framework thus explicitly recognizes that companies are shaped, but not necessarily trapped by their past. While preserving the cumulative character of knowledge-based activities, the model includes the possibility of strategic renewal by bringing in mechanisms and choices used for firms to alter path-dependency. The underlying assumption is that the strategic alternatives available to the firm are not infinite (as in many orthodox economic models), but neither are they singular nor definitive. What the framework intends to stress is that there is a margin for strategic maneuvering. Managers do have the potential to set technological and market trajectories, particularly early on in the development of a market (Teece, 2007). As Pisano(2002: 151) has noted:

“Much of the recent literature on organizational capabilities contends that learning is path-dependent. The seeds of today’s experiences are sown in yesterday’s experience. There is nothing in the clinical evidence [...] to refute this compelling principle. However, the clinical analyses also illustrated that the link between ‘leaning’ and ‘experience’ is not always straightforward. [...] Experience may provide opportunities for learning, but whether learning takes place from experience depends on specific actions and management decisions [...]”.

It is important to notice that the framework advanced in the present paper follows an integrative approach to dynamization, which complies with the view that “the term dynamic capability explicitly comprises both dynamic and static elements” (Schreyögg and Kliesch-Eberl, 2007)⁵. The view presented here is not that absorptive capacity is a dynamic construct in the strict sense, but rather that it may encompass key dynamic properties. The model is thus a means of introducing change from an “inside perspective” (in-built flexibility), in which a dynamic feature is added to the two more static dimensions (structure and combinative capabilities). Drawing on arguments of the strategic change, organizational learning and evolution literatures, I argue that both elements can coexist; not possessing contradictory logics.

⁵ The two other approaches to dynamic capabilities identified in the literature are (i) the radical dynamization approach and the (ii) innovation routine approach. The first confers total adaptability to the concept, whereas the second assigns the tasks of dynamization to a special type of routine called innovation routine. See Schreyögg and Kliesch-Eberl (2007) for a detailed review of the topic.

Organizational Mechanisms Associated to Adaptive Capabilities

I have put forward the proposition that adaptive capabilities are crucial for the development of absorptive capacity, as they provide flexibility for an organization to move into new directions. However, they have so far been defined and elaborated at a fairly abstract level. In this section, I examine more concretely their constituent elements (i.e. microfoundations), explicating the rationale behind them. I formulate propositions regarding four organizational characteristics attributed to adaptive capabilities: (i) the firm's slack resources, (ii) a climate of tolerance for failure, (iii) the willingness to cannibalize and (iv) external openness. All of these attributes increase the organization's flexibility and disposition to engage in knowledge diversity practices throughout the different learning processes — that is, the ability to adapt. They are to some extent related but do tap different aspects of an organization's openness to change. Hence, their inclusion in this study is driven by an understanding of the nature of path dependence (Sydow et al., 2009) and how these characteristics may facilitate organizational renewal (Danneels, 2008, Agarwal and Helfat, 2009). This paper thus echoes recent theoretical contributions which have called for further work on the microfoundations of organizational variables (Felin and Foss, 2005, Teece, 2007) and of absorptive capacity in particular (Volberda et al., 2010). As the managerial challenges posed by the three processes of explorative, transformative and exploitative learning in the context of absorptive capacity differ substantially (Lichtenthaler, 2009), I develop separate propositions for each one of them.

Slack resources. These are the human and financial resources (including time) not consumed by the daily operations of a firm, and can therefore readily be deployed in novel or other activities (Cyert and March, 1963). They can be understood as a 'reserve' of assets that can be put into use in the short-term for the acquisition of, for instance, new materials or equipment or for the hiring of new employees (Danneels, 2008). Organizations can accumulate slack resources either when they earn greater profits than they are expected to, or when they experience periods of economic downturn, when decreased demand levels release time of employees. According to Cyert and March (1963: 42), the term is said to comprise "the difference between total resources and the total necessary and required to maintain [an organization]". These authors were among the first to call attention to the fact that firms typically present slack which is non zero, contrary to most orthodox economic models. That is to say, stockholders are paid dividends in excess of those required to keep them (or banks) investing,

wages are granted in excess of those required to maintain labor, employees have more time at disposal to perform their tasks than needed, among other forms (Cyert and March, 1963).

I propose slack resources to be important for absorptive capacity, specially for the cases of deployment of technological knowledge that are not closely related to the firm's current knowledge base. As the behavioral theory of the firm (Cyert and March, 1963) suggests, slack is critical for firms that aspire to enter new domains of activity and therefore require substantial resource accumulation. "The excess" plays a crucial role in processes where firms are attempting to fill gaps in capabilities needed to adapt to technological, regulatory or market changes. Such processes require substantial efforts, for they are very time consuming and demanding. Moreover, organizational slack increase risk taking in firms, thus being very useful for dealing with major shifts in the external environment. It allows resources to be allocated to projects which would not be supported in a tight budget, as well as leading to an overall relaxation of controls which may be important for absorptive activities. For this reason, it plays an important "adaptive role" (Cyert and March, 1963: 44). Contrarily, when slack is limited, controls are intensified and attention shifts to efforts directed to improving productive efficiency with known technologies and processes.

Given these properties, slack has received vast attention in the literature (Danneels, 2008). It has specifically been "hypothesized to trigger innovation and to support the exploitation of environmental opportunities, as well as to smooth organizational performance in the face of environmental hostility" (Bourgeois, 1981: 39). Nevertheless, it has not been addressed as a direct antecedent of absorptive capacity. Slack is likely to be important throughout the three learning processes of absorptive capacity. Scanning the environment for the acquisition and assimilation of distant knowledge (i.e. exploratory learning) requires more resources than scanning for that of proximate knowledge, where search channels are established and cognitive schemes are familiar. Firms are likely to need to invest in novel network relations and in the development of expertise in new fields (Danneels, 2008). Similarly, the retention of non-local knowledge (i.e. transformative learning) is more challenging in such contexts. The less prior technological knowledge a firm has, the harder it is for it to maintain and reactivate additional knowledge (Lichtenthaler, 2009) and therefore, the higher the need for slack. Moreover, because the utilization of distant knowledge will often guide capability development and resource acquisition, slack is crucial for the exploitative learning processes too. For this reason I formulate the following propositions:

Proposition 1a: The higher the slack resources in a firm, the higher the level of exploratory learning (absorptive capacity).

Proposition 1b: The higher the slack resources in a firm, the higher the level of transformative learning (absorptive capacity).

Proposition 1c: The higher the slack resources in a firm, the higher the level of exploitative learning (absorptive capacity).

Tolerance for failure is a feature of the “organizational climate” and is understood as the extent to which errors and failures are accepted or seen within the firm as an opportunity to learn (and therefore, not punished). If managers and other organizational members consider failure something to be avoided at all costs with awful consequences for employees, they discourage entrepreneurial activities. People will then be reluctant to take on new tasks or to experiment with new technologies and, instead, will tend to concentrate on existing and conventional processes of production and marketing (Atuahene-Gima, 1997). On the contrary, if “failure-tolerant leaders” (Farson and Keyes, 2002) put up with mistakes as an inevitable part of a learning process, they provide support to those engaged in risky projects which engender the fear of failure (Danneels, 2008) and invite innovation. Creating such a setting is however not a simple task, since not all types of failure lead to useful learning or can be excusable (i.e. failures that threaten health and safety issues must not be tolerated). For this reason, scholars (Sitkin, 1992, Farson and Keyes, 2002) have differentiated between the “right” or the “intelligent” type of failure from the lethal one. While the first is used to to denominate well-thought-out efforts that yield valuable insights, the latter refers to half-hearted, careless efforts with poor results. Strategies to achieve an “intelligent” failure tolerant environment include publicly acknowledging failures of employees and of oneself (and also of the useful lessons learned from them) and publicizing employee mobility after failure (Farson and Keyes, 2002).

I see tolerance for failure as an important antecedent for the exploitative learning processes of absorptive capacity. Because it constitutes the processes of matching new applications to a given technological platform, it is inescapably a practice of trial and error, in which mistakes cannot be completely avoided. The same is not true for the initial process of exploratory and transformative learning, which are ‘experimental’ activities with no concrete or tangible outcomes. Research in organizational behaviour suggests that “failure enhances adaptation to changing environmental conditions and systemic resilience to

unknown future changes” (Sitkin, 1992: 242). To promote the uncertain processes of change, managements have to build an environment in which employees feel comfortable about failure. Therefore a non-punitive climate, where failures are, for instance, taken with humor, and individuals are encouraged to undertake activities with uncertain outcomes “may help organisations learn and build new capabilities” (Danneels, 2008: 524). This kind of permissive atmosphere towards mistakes is even more important in processes of change which involve daring initiatives, not allowing individuals to become immediately recognized for their unsuccessful projects or ideas or to suffer embarrassment and a loss of esteem and stature. Because failure has been widely acknowledged to be an integral part of innovation (Farson and Keyes, 2002), there exists extant literature showing that failure management affects the propensity of employees to engage in innovative and entrepreneurial activities (Atuahene-Gima, 1997, Hornsby et al., 2002). Yet it has not been directly related to absorptive capacity, as stated in the proposition below:

Proposition 2: The higher a firm’s tolerance for failure, the higher the level of exploitative learning (absorptive capacity).

Willingness to cannibalize “refers to the extent to which a firm is prepared to reduce the actual or potential value of its investments” (Chandy and Tellis, 1998: 475). In other words, it denotes the *disposition* of an organization to give up its investments and current competencies (Nijssen et al., 2005). According to Chandy and Telis (1998), cannibalization constitutes an organizational characteristic of a firm, insofar as it is conceptualized as an “attitudinal trait” that resides in the culture of a firm.

In the strategic management literature, cannibalization is a key variable explaining why certain organizations are better than others at developing radical innovations (Chandy and Tellis, 1998). This is because the pursuit of radically new opportunities may involve shifting the focus from current assets (which may become obsolete) to developing new ones; what may mean sacrificing current sources of profit (Danneels, 2008). As cannibalization provides incentives to the development of new capabilities, it compensates for the negative effects of inertia and other capability-rigidities (Nijssen et al., 2005). It is therefore viewed as a desirable trait of organizations (Chandy and Tellis, 1998). Specifically three dimensions of this construct have been distinguished, i.e. cannibalization on previous investments, capabilities, and sales (Nijssen et al., 2005). That is, it has been related both to tangible and to non-tangible assets. Despite the expected positive returns, cannibalization clearly is a difficult and painful thing to do (Chandy and Tellis, 1998).

I relate willingness to cannibalize to absorptive capacity as a means of accounting for the fact that unlearning is a key and often frequent part of learning. “Before organizations will try new ideas, they must unlearn old ones by discovering their inadequacies and then discarding them” (Nystrom and Starbuck, 2004: 100). In other words, absorptive activities may involve replacing important attributes of the company’s organization and strategy, such as lines of products, the base of technological knowledge or the relationship with a certain group of customers. This often happens in the form of a cannibalization process, through which firms can “erase” dominating ideas, disconfirm past programs, discard assets or organizational routines and thereby become prepared to experiment with new knowledge. Besides, willingness to cannibalize impacts an organisation’s receptivity towards novel technologies and openness to change, since commitment to existing resources is somewhat limited. I expect willingness to cannibalize to be specially relevant in contexts of high technological distance, in which the success of a new technology can cannibalize a firm’s assets in prior technology if they are unrelated to a large degree. To embrace the new and give up the old is supposed to be more important in these contexts.

Nevertheless, unlearning is likely to take different connotations depending on the stage of the absorption process. Throughout exploratory learning process, unlearning or cannibalization will typically be focused on intangibles, such as prior technological knowledge and relationships with certain partners. Throughout the exploitative learning process, cannibalization is expected to be more important and to involve both intangible (i.e. sales and capabilities) and tangible assets (i.e. capital investments). For the transformative learning process, however, cannibalization is not expected to be necessary, for it basically encompasses knowledge management practices, affecting how knowledge is shared between the different parts of the organization and hence are not expected to be wiped away. Therefore I put forward the following proposition:

Proposition 3a: The higher the firm’s willingness to cannibalize, the higher the level of exploratory learning (absorptive capacity).

Proposition 3b: The higher the firm’s willingness to cannibalize, the higher the level of exploitative learning (absorptive capacity)

External openness is the final antecedent considered and, like previous ones, is understood as an organization-wide characteristic. It denotes the ability to

maintain close relationships with external partners (Walter et al., 2006, Laursen and Salter, 2006). It is, in other words, the capability to interact with other organizations or *openness* towards the external environment. External openness is defined as part of a broader ‘network competence’ (Kale et al., 2000) relating to a range of social competences. They involve aspects such as communication ability, extraversion, cooperativeness, conflict management skills and sense of justice (Chesbrough, 2003, Walter et al., 2006). Since business interactions are essentially interpersonal exchange situations, the ability to adapt to various social situations and to build mutual trust, respect and friendship is highly valuable, not only for establishing interaction with partners, but also for facilitating learning (Kale et al., 2000).

As a significant part of absorptive activities is derived from relationships with external partners, I suggest that external openness is a direct antecedent of absorptive capacity, specifically at the stage of exploratory learning. Because much of the knowledge transfer and exchange takes place in inter-organizational ties (Powell et al., 1996), the extent to which employees are able to cultivate and shape close relationships (both formally and informally) is crucial in this regard. Strong ties between organizations provide channels through which partners learn about other firms’ competencies (Kale et al., 2000). The literature on search strategies (Katila and Ahuja, 2002, Rosenkopf and Almeida, 2003, Laursen and Salter, 2006) suggests that searching widely and deeply across a variety of search channels can provide ideas and resources that help firms overcome local search bias (where a firm’s R&D activity is closely related to its previous R&D activity). In order to access a variety of knowledge sources, firms need to scan across a wide number of actors and be able to sustain relationships (that is, to possess strong external openness). By doing so, they increase their exposure and access to new technological developments which would otherwise be unavailable, enhancing their potential to span technological boundaries. Hence the inputs firms receive from outside partners are a key source of dynamism to organizations. Because external relations increase the possibilities of integrating knowledge from non-local domains, they are instrumental in breaking path-dependent patterns of knowledge accumulation. For this reason, I relate openness towards external partners to the development of absorptive capacity. Although these attributes are more important for the initial scanning activities of acquisition and assimilation of external knowledge (i.e. exploratory learning), I expect them to play a role of the application process as well (i.e. exploitative learning). This is because firms work collaboratively at all stages of the innovative process, including the phase of development of concrete solutions, such as the user-producer interactions (Lundvall, 1992). Many develop applications with outside partners, in particular if they do not operate in common markets but do share an interest in the common technological

platforms. Transformative learning, however, is not affected by these attributes, as it is intrinsically an internal activity.

Proposition 4a: The higher the firm's external openness, the higher the level of exploratory learning (absorptive capacity).

Proposition 4b: The higher the firm's external openness, the higher the level of exploitative learning (absorptive capacity).

In sum, the notion advanced here is that, at least analytically, the organizational antecedents of absorptive capacity can be disaggregated into two sets of capabilities: combinative and adaptive. While the former provides the basis for the internal coordination mechanisms, the latter provides the seeds of change to an organization. The essential argument of this paper is that elements that soften path-dependent patterns and that promote change must be included to absorptive capacity, if it is to be understood as a dynamic capability and not as a structural part of the firm, in the sense proposed by Zahra and George (2002). Quite obviously, the risk of organizational rigidity cannot be completely eliminated by the inclusion of adaptive capabilities. They are expected to provide the fundamentals of dynamics and the agility needed for transforming learning paths, and therefore affecting the predisposition of firms to change. In any sense they should be seen as automatic guarantees. On the contrary, they are seen to provide the social context and the economic incentives for flexibility, which, if undertaken proactively, may enable firms to cope with change and reduce obsolescence. As a result, companies with well-developed adaptive capabilities are expected to respond better to external environmental changes.

CONCLUDING REMARKS

Zahra and George's (2002) understanding of absorptive capacity as a dynamic capability constitutes an important contribution which revitalized research in the topic and linked it to recent developments in the field of strategic management. This reconceptualization, however, brought forth new concerns about the nature of the concept and renewed questions about the foundations of firm behavior. This is because it failed to incorporate dynamics and explain how absorptive capacity could promote renewal and organizational change. In an attempt to address this gap, this paper has elaborated on the dynamization of the construct with the aim of providing theoretical coherence and clarity. While not denying

that the nature of knowledge investments is path-dependent and cumulative, a framework has been proposed to indicate that absorptive capacity also entails dynamic properties; that is, it is in itself adaptable too.

This paper offers two key contributions. First, it proposes a working definition of the term ‘adaptive capabilities’, which constitutes a step towards a dynamic model of absorptive capacity, reflecting the idea that companies may not possess all required resources and competences to utilize ideas from outside (there may exist a strategic knowledge gap). If absorptive capacity is truly to be conceived as a manifestation of dynamic capability, it must also embrace elements that counter-balance path-dependency. I view the concept of adaptive capabilities as highly promising for understanding the origins of absorptive capacity, as well as the tensions underlying the paradoxical logics of path-dependence and change. Second, the range of organizational antecedents to absorptive capacity has been extended in order to include both stable and dynamic dimensions. I argue that both elements can coexist, not possessing contradictory logics and being (at least analytically) distinctive. Instead of seeing them as trade-offs (either/or-thinking), I refer to them as paradoxical capabilities (according to both/and-thinking). The dynamic dimension is set to comprise a number of organizational attributes (i.e. slack resources, tolerance for failure, willingness to cannibalize, external openness) that drive organizational renewal. As a result, this paper amplifies the attention for one of the most important (and often neglected) basic assumption of absorptive capacity: absorptive capacity does not reside in R&D investments alone.

The framework yields important implications for practitioners too. First of all, it sensitizes managers to the importance of absorptive capacity in securing not only performance, but also long-lasting organizational renewal and responsiveness. It opposes the predominant view of absorptive capacity as a driver of inertia in organizations. It also points to directions in which managers can follow to allocate limited resources to develop absorptive capacity, since it points to the mechanisms and practices that can drive dynamics into an organization. It specifies the managerial practices companies should adopt in order to design their internal organization so as to properly acquire, assimilate and take advantage of knowledge generated by external sources. By doing so, it clarifies that absorptive capacity is gained not only indirectly (through R&D investments), but also directly through internal practices of knowledge sharing and of knowledge diversity (combinative and adaptive capabilities respectively). The capability to create and use new outside knowledge results from the collective ability of employees to exchange and combine knowledge and to be receptive and flexible towards new developments. As a result, the model puts

managers at the centre of the stage, in the sense of calling them to assume an active role in the building of absorptive capacity; an active role in terms of securing “the right” broad organizational context which can lead, directly or inadvertently, to the dissolution of self-reinforcing loops. As the organizational attributes related to adaptive capabilities (i.e. slack resources, tolerance for failure, willingness to cannibalize, external openness) are subject to strategic intent, managers can use them to influence desirable outcomes such as innovation and performance.

A noteworthy limitation of the framework proposed here is that it suggests a set of organizational antecedents to absorptive capacity based on the review of the literature in the fields of organizational learning, innovation and dynamic capabilities. It therefore lacks empirical support about the phenomenon – a hint that it may not have exhausted all the possible organizational antecedents. There may exist other important drivers for the development of absorptive capacity not identified in the present paper. Therefore further conceptual and empirical work is required to refine the model. A first obvious step is to empirically assess it; that is, to gather evidence of which antecedents may or may not actually work. This line of investigation could also examine whether or not the two sets of capabilities (combinative and adaptive) can be distinguished empirically (and not only theoretically) as autonomous constructs. Another direction for future research would be to consider not only organizational-level attributes, but also individual ones. These attributes could include, for instance, the position of key individuals in professional networks, the entrepreneurial orientation of employees and the cognitive attributes of top management.

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FIGURE

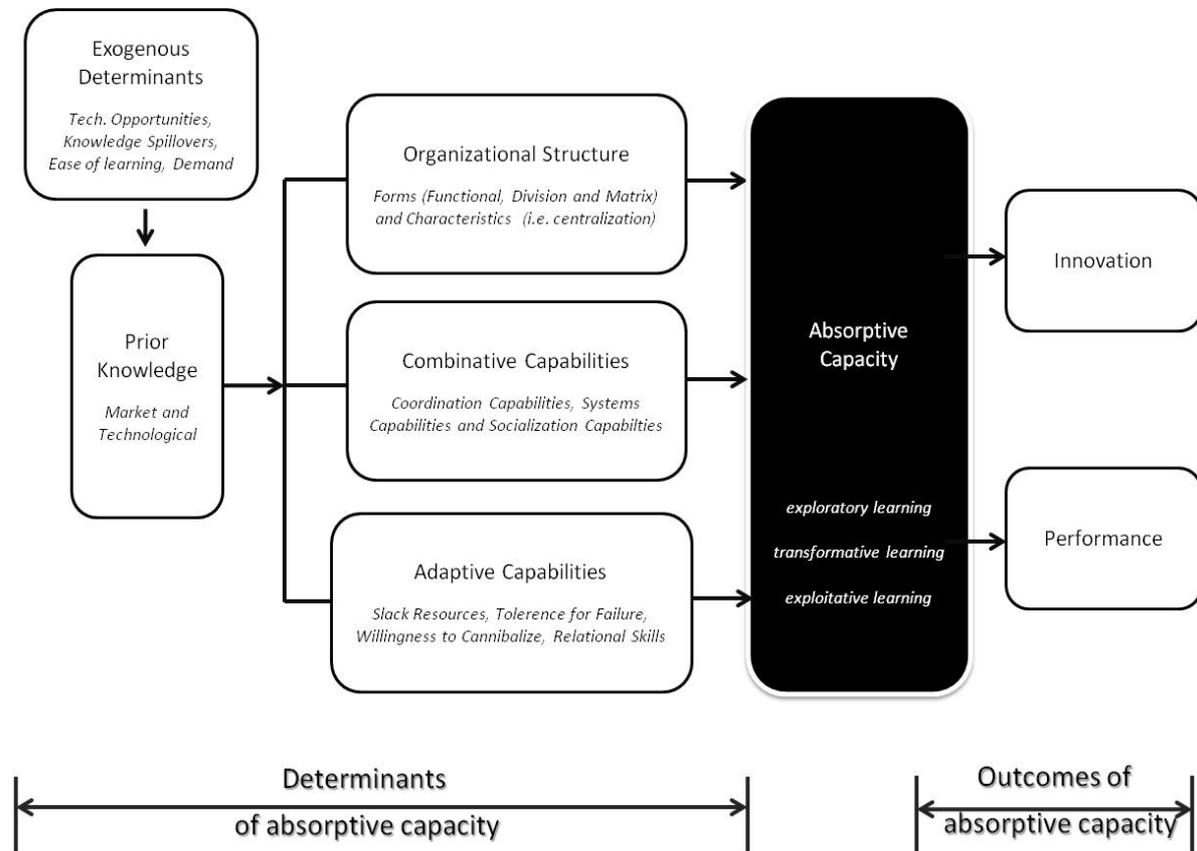


Figure 1: *Toward a General Model: Antecedents and Outcomes of Absorptive Capacity*

Source: Author's elaboration based on Cohen and Levinthal (1990), van den Bosch (1999), Lane et al. (2006) and Lichtenthaler (2009)

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