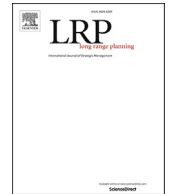




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Development of absorptive capacity over time and across boundaries: The case of R&D consortia

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ABSTRACT

Absorptive capacity (AC) has been identified as the ability of firms to acquire, assimilate, and apply external knowledge, and thus as a pre-condition for learning from knowledge environment. However, extant literature has focused on AC as (1) a static and (2) a firm-centred concept. In particular, there is little conceptual framing and empirical evidence of how AC develops over time and across boundaries. Taking R&D consortia as the unit of analysis and based on insights from three in-depth case studies of collaborative R&D, our contribution is a framework for AC development over time and across inter-organizational, intra-organizational, and practice boundaries at different stages of collaboration in R&D consortia. Using this framework, we identify a set of mechanisms which enable the development of AC and we discuss the preconditions for these mechanisms. For R&D managers, our research implies that in order to enhance effectiveness of knowledge transfer and learning in R&D consortia they need to develop a strategy that (1) supports learning and AC development throughout the whole cycle of the collaboration, not only by focusing on intra-firm capabilities, but in particular by providing flexible interfaces for overcoming a variety of interaction and learning boundaries between heterogeneous R&D partners, and (2) enables the integration of created and acquired knowledge within the organization once the collaboration is over.

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Introduction

Defined as the ability to identify, assimilate, and apply external knowledge (Cohen and Levinthal, 1990), absorptive capacity (AC) offers a useful approach to conceptualize and understand how organizations acquire and exploit knowledge – and learn. The concept has inspired a wave of research over the last two decades as authors have explored AC's antecedents (Jansen et al., 2005; Lane and Lubatkin, 1998; Nooteboom et al., 2007), and its consequences for innovation (Hurmelinna-Laukkanen et al., 2007; Tsai, 2001) and competitive advantage (Escribano et al., 2009; Todorova and Durisin, 2007; Zahra and George, 2002).

However, extant research remains inadequate in explaining and understanding a number of AC aspects. First, most AC research has focused on single organizations or dyadic relations, while there is a dearth of research on how AC develops when

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multiple organizations are involved and various types of expertise prevail. Although there are a limited number of contributions which have explored AC at the network level (e.g. Müller-Seitz, 2012), no particular theoretical framework has captured the development of AC in those contexts. Second, while there are some conceptual papers that offer theoretical understanding of the processes and mechanisms that underlie AC (Lane et al., 2006; Lewin et al., 2011; Todorova and Durisin, 2007; Volberda et al., 2010; Zahra and George, 2002), there is a lack of empirical studies which examine the dynamics of AC development over time. The majority of studies remain limited to applying the concept in a static manner, where AC is usually operationalized as knowledge stock, and widely viewed as an independent variable. Attempting to address this issue, we treat AC also as a dependent variable. While AC remains an enabler for learning, we argue that there is a development of AC itself over time through learning and through specific conditions of learning in consortia. We will show how various mechanisms contribute to the development of AC when more than two organizations – and thus a higher level of heterogeneity – are involved.

We address the above research gaps by developing a framework to apply and operationalize AC and learning in the context of three R&D consortia cases which we define as collaborative R&D projects involving more than two partners. Following Lane et al.'s (2006) framework, we define consortium-level AC as an ability that develops within the context of R&D consortia and through three sequential processes of (1) recognizing and understanding potentially valuable new knowledge across partners through *exploratory learning*, (2) assimilating valuable new knowledge across partners through *transformative learning*, and (3) using the assimilated knowledge to create new knowledge and commercial outputs through *exploitative learning* within individual organizations.

R&D consortia significantly increase the opportunity space for learning through providing access to new resources and capabilities while presenting participating firms with a range of challenges. By adding heterogeneity in terms of types of organizations and in terms of types of knowledge and professions involved, R&D consortia increase the number of potential complementarities of knowledge assets and capabilities (Feller et al., 2013; Ingham and Mothe, 1998). At the same time, the very heterogeneity that makes R&D consortia attractive as innovation platforms potentially interferes with the development of common grounds for knowledge exchange, collaborative learning, and knowledge exploitation. Partners with different organizational missions and institutional backgrounds add different types of knowledge expertise, experiences, professional norms and routines and expectations. As such, R&D consortia entail a higher level of complexity, exposing participants to coordination challenges and potential for conflicts, which in turn may hinder the collaboration performance (Dougherty and Dunne, 2011; Doz et al., 2000; Sydow et al., 2012). Those challenges are not necessarily static, as we may expect that the roles of actors, the nature of interactions, and the opportunities for learning and exploitation change over the life-time of R&D consortia.

Against the background of these assumptions, we develop a framework that captures such dynamic heterogeneity and allows us to answer our main research questions, i.e. (1) what constitutes AC in R&D consortia, (2) how does learning from external knowledge occur in heterogeneous multi partner collaborations and thus (3) how does AC itself develop over time against the background of those different types of boundaries generated by multi-dimensional heterogeneity of R&D consortia? Our starting premise is that working together and learning under conditions of heterogeneity necessitates crossing multi-dimensional boundaries (Carlile, 2002; Hsiao et al., 2012; Oborn and Dawson, 2010). Our framework thus defines and describes different types of boundaries that need to be overcome in order to allow learning to occur. Taking R&D consortia as our unit of analysis, we analyze the development of mechanisms that support learning and the development of AC across multiple boundaries and throughout the life-cycle of R&D consortia. As such, our analysis of AC has a focus on the consortium level. However, given that participating organizations contribute to and learn from consortia, inevitably, our analysis of AC encompasses learning at the organizational level.

We contribute to the literature by offering a framework that helps explain the 'micro-foundations' (Lewin et al., 2011) of the interaction of AC and learning in heterogeneous settings (R&D consortia) during the life time of an R&D consortium. Our methodological approach to analyze learning and AC in this framework is qualitative. Compared to the quantitative methods that are vastly used in the analysis of AC (Easterby-Smith et al., 2008; Volberda et al., 2010), this allows an in-depth analysis of contexts and their changes over time.

The rest of the paper is organized as follows. We first present the insights from the literature to discuss past AC research and its potential areas worth of further exploring. We then develop a framework that allows responding to our research questions regarding the constitution and development of AC across multiple boundaries in R&D consortia over time. A methodology section outlines how our research was conducted and provides a brief description of the three cases before delving into a more analytical discussion of the findings. The paper concludes with presenting the theoretical and empirical implications of the findings.

Absorptive capacity: concepts and applications in the existing literature

Owing to more than two decades of research, the AC literature has progressed significantly. Initially, Cohen and Levinthal (1990) conceptualized AC as a capability of a firm to identify, assimilate and apply external knowledge. Research has established that AC enhances inter-organizational learning (Lane and Lubatkin, 1998; Lane et al., 2001) and supports reaching out to and collaborating with geographically distant partners (De Jong and Freel, 2010). Consequently, AC was found to contribute to innovations (Ritala and Hurmelinna-Laukkanen, 2013; Rothaermel and Alexandre, 2009; Tsai, 2001) and to

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