

1. Introduction

Innovations and the knowledge upon which they are based are rarely created anew. As March and Simon (1958: 177-188) posited in their seminal book, in organizational contexts, most innovations come from borrowing rather than from invention. This suggests that the generation of innovations might not be a “true” act of creation *per se*, but rather might be based on the novel combination of different sources of knowledge borrowed from others (Carlile and Reberich, 2003; Hargadon, 2002; Hargadon and Sutton, 1997; Leonard-Burton, 1995; Schumpeter, 1934). This book is about the process through which individuals in organizations innovate by acquiring, understanding and assimilating knowledge (from within or from outside the organizations), and ultimately use it in to produce new knowledge and understanding. The reason for considering the process of innovation within organizations is because most of the literature in innovation management takes organizations as the unit of analysis and studies the conditions under which these aggregates are more or less capable of producing new knowledge. However studying the conditions that promote organisations’ aggregate ability to generate innovations ignores the fact that their innovativeness is the result of a complex interplay of different mechanisms involving several employees/individuals. In particular, it is my contention that in order to better understand how organizations innovate, we should study how *individuals in organizations* innovate. Moving the focus of the analysis from a single organization (i.e. company or business unit) to the individuals who work in an company or a business unit allows a more comprehensive understanding of how knowledge is mobilized through individuals exchanges, and how the innovative recombinations that are at the core of the innovative process occur. Put simply, this book argues and provides empirical evidence from the fact that organizations do not innovate, people do (Hargadon, 2003).

There are clearly different theoretical perspectives on the driving factors behind innovation in organizations, and it is not within the scope of this book to summarize the different research streams in which the study of this phenomenon has been declined over time. Instead, this study will focus on one perspective that has received a lot of attention from academic research but not yet enough from a practical standpoint: the absorptive capacity framework proposed by Cohen and Levinthal in one of the mostly widely cited papers in organization theory (Cohen and Levinthal, 1990). Although it was initially popularized and empirically tested as a theory of organizational innovations, because it has been primarily investigated at the organizational or business unit level its underlying mechanisms have received comparatively less attention. As it will become clear in the remainder of this chapter, this theoretical approach will acquire a stronger theoretical basis and practical empirical implications when considered at the level of individual innovativeness.

Absorptive capacity is an organisation's ability to understand, acquire, use, and ultimately take advantage of external knowledge. This simple yet powerful idea, has inspired many subsequent studies.¹ The theoretical perspectives proposed by Cohen and Levinthal has become a paradigm of the innovation and organizational literature as demonstrated by countless studies devoted to testing their theoretical propositions (Cohen and Levinthal, 1990; Henderson and Cockburn, 1994; Mowery and Rosenberg, 1991; Mowery, Oxley and Silverman, 1996; Kim, 1998; Van den Bosch, Volberda and de Boer, 1999; Lane, Salk and Lyles, 2001; Tsai, 2001).

A close reading of the original paper and of much of subsequent research, however, reveals an interesting paradox: in spite of the large number of studies that test the predictions of the absorptive capacity theory, the actual process through which organizations acquire, assimilate, and use external knowledge to generate innovations has never been analysed empirically. As argued in a recent review by Volberda, Foss and Lyles (2010), the mechanisms through which individuals inside an organization benefit from external knowledge in generating innovations remain unclear. Even though Cohen and Levinthal's original research theorizes about the absorptive capacity process and how it is supposed to

¹ As of September 2017, Google Scholar shows that the three papers in which Cohen and Levinthal (1989; 1990; 1994) introduced and developed the concept of absorptive capacity have received a combined total of over 43,000 citations.

unfold in order to realize its predictions, ultimately it ignores the mechanisms proposed in the empirical analysis by relying on an aggregate measure of R&D intensity (i.e. the amount of money spent in research and development divided by sales) to capture this extraordinary complex process of acquisition, assimilation, and use of external knowledge. This is an important limitation of this research. In this book, through an in-depth case study of the Research & Development division of a large multinational high-tech company, I seek to analyse the mechanisms originally identified by Cohen and Levinthal as the drivers of organizational innovative capabilities.

The vast majority of empirical studies on absorptive capacity have used organizational aggregates (i.e. company or business units) as units of analysis and primarily focused on the R&D investment of these units. They argue that higher R&D spending leads to greater absorptive capacity (Lane, Salk and Lyles, 2001; Lane and Lubatkin, 1998; Van den Bosch, Volberda and de Boer, 1999; Mowery, Oxley and Silverman, 1996; Tsai 2001; Nicholls and Woo, 2003). Implicit in this link between the intensity of R&D and absorptive capacity is the idea that external knowledge can be easily accessed and seamlessly acquired, understood and converted into organizational innovations. Yet, the specific details of how individuals acquire, share, and transform external knowledge into commercializable innovations has received only limited attention by organizational and innovation management scholars.

Building on the idea of innovation as the novel and original combination of existing sources of knowledge borrowed from others, I argue that both the type of external knowledge sourced and its subsequent sharing through social interactions are critical aspects of the absorptive capacity process. With regard to external knowledge, the absorptive capacity literature focus on R&D intensity suggests that all forms of external knowledge are equally relevant and accessible. However, research on scientific capability and organizational innovation has shown that different types of knowledge have different effects on innovativeness (Gittelman & Kogut, 2003). This raises the question of how different types of knowledge affect the absorptive capacity process. In particular, I am interested in whether there are differences in how individuals access and internalize different types of knowledge and whether all types of external knowledge are equally important in the generation of innovations.

With regard to knowledge sharing within organizations, absorptive capacity theory recognizes that interactions among individuals possessing different

knowledge structures are critical to innovation. In particular, Cohen and Levinthal (1990: 133) claim that “[...] interactions amongst individuals who possess diverse and different knowledge structures will augment the organization’s capacity to make novel/original links and associations -innovating- beyond what any individuals can achieve.” However the extent to which these interactions help create novel linkages and associations cannot be taken for granted. Indeed, extensive research from the organizational learning and knowledge management literature has documented the difficulties associated with the process of acquiring and disseminating knowledge in organizational contexts (Szulanski, 1996; Argote 1999: 143-182; Hansen, 1999; Reagans and McEvily, 2003). This raises the question of what enables individuals within an organisation to share and combine the new/diverse external knowledge to generate innovations by interacting with their colleagues. Specifically, I explore the extent to which external knowledge is important in itself and the extent to which the value of external knowledge depends on the opportunities that exist for combining it, based on the nature of interactions among individuals.

To address these two gaps, this book focuses on how the type of external knowledge is internalized, and how combinations of internalized knowledge through social interactions help explain the absorptive capacity process. Building on the view of innovation as the result of collective rather than individual efforts (Hargadon, 2003; Simon, 1991), I study the social underpinnings of absorptive capacity by focusing on explaining the differences in individuals’ ability to contribute to organizational innovations. I argue that external knowledge enhances individuals’ contribution to organizational innovativeness in two ways: directly through the knowledge they source from outside the organization; and indirectly through interactions with colleagues who source different types of external knowledge.

Consistent with other research on absorptive capacity, I will demonstrate empirically that access to external knowledge is an important element in enhancing individuals’ ability to help generate organizational innovations. I also argue, however, that as individuals inside the organization are likely to access different types of external knowledge, the diversity of knowledge across the workforce has important implications for their collective ability to innovate (Gittelman and Kogut, 2003). As there are variations in individuals’ knowledge structure because of differences in external knowledge sourced, interactions among individuals within organizations are also crucial to understanding how

different types of external knowledge inform the process of innovation. By making a distinction between the different types of knowledge available to individuals through their contacts (knowledge structure) and the type of social systems in which they are embedded (social structure), I evaluate how an individual's network affects indirect access to new knowledge and contributes to organizational innovations.

I test these ideas in the context of intra-organizational relationships among 276 researchers, scientists, and engineers working in 16 different R&D laboratories of a multinational semiconductor company. The evidence in this book has been tested empirically in several published papers using the same dataset that are dedicated to a specific aspect of how knowledge is access and mobilized in this organization (Tortoriello, 2015; Tortoriello, McEvily, and Krackhardt, 2015; Tortoriello, Reagans and McEvily, 2012; Tortoriello and Krackhardt, 2010). In particular results presented here indicate that not all types of knowledge have the same impact on innovativeness, and that individuals benefit from external knowledge both directly, through the external knowledge they source themselves, and indirectly, through the external knowledge sourced by their colleagues. These findings contribute to research on absorptive capacity and innovation by focusing explicitly on the type of knowledge sourced by individuals and by providing an in-depth examination of how knowledge heterogeneity affects innovative capabilities through knowledge sharing interactions.

This book also contributes to research on social networks, knowledge management and innovation by focusing directly on the extent to which the redundancy of knowledge available to individuals through their contacts overlaps with, or is orthogonal to, the redundancy of their contacts. Indeed, while traditional structural analysis tends to assume that a one-to-one relationship between the structure of individuals' networks and the type of knowledge that flows in those structures², there are several reasons to believe that the homogeneity/diversity of the knowledge available to individuals is not necessarily driven by how redundant or sparse individuals' network relationships are.

² In particular a traditional assumption in structural analysis is that networks rich in common third-party ties will typically provide access to homogeneous/redundant knowledge, while networks rich in structural holes (Burt, 1992) – that are sparse and have several – will typically provide access to diverse/non-redundant knowledge.