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## The dynamics of collaborative practices for knowledge creation in joint R&D projects

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### ABSTRACT

**Purpose:** We aim to elucidate how the dynamics of collaborative practices in research and development (R&D) projects occur and to reveal the main practices adopted in developing an ambidextrous project. The dynamics of R&D practices in knowledge creation arise from complementary practices of exploration and exploitation undertaken over the lifespan of an inter-organizational project that trigger an ambidextrous process of innovation.

**Design/methodology/approach:** This study involves interpretative guidance. We elaborate upon the history of the development of a collaborative R&D project in an intensive knowledge industry, the semiconductor industry, and use narrative as the methodological framework in a single case study with a processual approach. We conducted 65 interviews that were supported by secondary inventories of data that consisted of 167 files.

**Findings:** The type of collaborative practice adopted in a joint R&D project varies based on the stocks of knowledge required to make the concept a reality and also as a strategy of knowledge creation adopted in each project phase, ensuring a dynamic synthesis between tacit and explicit knowledge. We propose a three-dimensional model that accounts for the adoption of different practices throughout the life cycle of a collaborative ambidextrous R&D project.

**Practical implications:** We identified 19 collaborative practices of inter-organizational knowledge creation that ensure the dynamics of innovation using complementary exploration and exploitation approaches.

**Originality/Value:** This study makes important contributions to the relational view and the theory of knowledge creation, offering a contribution to understanding the origin of ambidextrous practices in knowledge creation throughout the life cycle of an R&D project.

### 1. Introduction

A primary factor of productivity and competitiveness in the current economic paradigm involves the capacity of individuals and organizations to generate, process and transform information and knowledge into economic assets (Nonaka et al., 2006). Given that an important asset of knowledge is innovation, several studies have attempted (and struggled) to identify the drivers of innovation and how innovation processes should be managed to increase innovative performance (Teecce, 1986; Brown and Eisenhardt, 1997; Crossan and Apaydin, 2010).

Although a significant stream of research has highlighted the innovation performance implications of combining knowledge resources from different origins (Graetz and Smith, 2007; Nonaka et al., 2014), the origins of knowledge are but one of the determinants of innovation. In fact, the characteristics of the processes by which firms search for new knowledge also strongly influence

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innovation and can shape – or even subvert – the impact of the origins of knowledge on innovation outcomes (Fleming and Sorenson, 2001).

To capture this innovative behavior, Capaldo and Petruzzelli (2011) refer to the notion of search span, i.e., the extent to which firms search for new knowledge across different knowledge domains. Studies advancing a subject's knowledge frontiers have deepened the concept of ambidexterity, which postulates that the dimensions of exploration and exploitation are used simultaneously (Nonaka et al., 2014) and are enhanced by complementary knowledge internal and external to the organization.

The challenge is that knowledge increasingly extends beyond the boundaries of the firm, and the ability to build external alliances is an important source of new ideas and information that leads to technology and innovations that promote business performance (Dyer and Singh, 1998). In this sense, interorganizational cooperation allows companies to access new resources and complement existing resources, particularly in research and development (R&D) projects. In particular, R&D alliances have become widely adopted as an open innovation practice (e.g., Schilling, 2009) and are increasingly important units of analysis for understanding competitive advantage based on innovation (Capaldo and Petruzzelli, 2014).

Some authors (Dyer and Singh, 1998; Nonaka et al., 2014) who believe that the ability to create and use knowledge to generate innovation is an important source of sustainable competitive advantage to companies emphasize that this consideration still has gaps because does not identify with any precision which knowledge process is more likely to generate innovations, accelerate the implementation of an innovation or support organizational innovation (Quintane et al., 2011).

Reflecting upon these studies' main contributions, we see a theoretical gap, which is considered here as a "black box". The theory of knowledge creation and the relational view have thus far generated substantial knowledge. For example, we know that collaborative practices are essential to the process of knowledge creation, and we know that knowledge creation leads to the creative process of innovation. In addition, the Socialization, Externalization, Combination and Internalization (SECI) process and the conversion of tacit and explicit knowledge become important conditions for dialectic knowledge creation when applied to a "BA" and, in turn, act as mediators in this process. As highlighted in the literature review, many recent studies, such as Petruzzelli (2014), Nonaka et al. (2014) and Capaldo and Petruzzelli (2015), have demonstrated that exploration and exploitation strategies have been combined to improve an organization's innovative performance. However, these incipient studies have only begun to explain the collaborative practices that ensure effective knowledge creation for innovation, the best practices that generate tacit and explicit knowledge, and the ambidextrous R&D practices that lead to knowledge creation.

Even with scholarly advances in constructing a theoretical framework based on the theories and concepts of organizational knowledge, important gaps remain, such as the need to deepen the understanding of the knowledge creation process and, in particular, the practices employed by the actors involved in this process (Zboralski, 2009; Sun, 2010; Serenko, 2010). The dynamics of collaborative practices are not adequately explained by current theoretical perspectives, which present these practices as a "black box" in the study of inter-organizational relationships. Therefore, we ask the following questions to discover how the dynamics of collaborative practices of knowledge creation occur in collaborative R&D projects: Which types of collaborative practices of knowledge creation foster innovation? Do these practices change over the evolution of a collaborative project?

The study of collaborative practices in joint R&D projects is particularly relevant for project-intensive industries, as the survival of these industries often depends largely on their ability to accelerate innovation (Assudani, 2009). Moreover, the actors in these industries are increasingly using collaborative arrangements to meet this demand (Shih et al., 2008).

In seeking answers to our research problem, we collect evidence from collaborative projects in the semiconductor industry. Specifically, we examine the FD-SOI 28 nm transistor project, which is considered the most important collaborative microelectronics project in the French microelectronics cluster known as Minalogic, in Grenoble, France. This case provides a valuable example of how collaborative practices are implemented in joint R&D projects in the semiconductor industry. The collaborative FD-SOI collaborative project consisted of an ambidextrous innovation process using a combination of collaborative knowledge creation processes. We chose this unique case because it has an important place in the history and development of the transistor and because it overcame one of Europe's difficulties in innovating in knowledge-intensive industries, i.e., the difficulty of transforming academic knowledge into innovation (European Commission, 2011).

To solve the research problem, the article is structured in five parts. After the introduction, we present the theoretical framework that supports the development of this research, as well as the gap it is intended to fill as a theoretical contribution. The third section presents the methodological procedures. Then, we present the project's historical narrative and the data emerging from this process, before we present our final considerations.

## 2. Theoretical conversation

### 2.1. Collaborative practices in knowledge creation

Strategically, collaborative R&D projects open up innovation processes by means of collaboration with external actors, which leads to the combination, complementarity and creation of new knowledge across organizational boundaries (Davis and Eisenhardt, 2011). Technological alliances effectively help companies access additional resources and achieve competitive advantages (Krammer et al., 2016). In this regard, organizations have adopted innovation processes that are increasingly collaborative, open, and networked.

Today, organizations in many fields of human service are searching for and implementing best practices to increase their effectiveness in this context because they are under pressure to accomplish more with fewer resources and to meet increasingly higher performance expectations. Best practices may emerge from the innovative work of researchers and practitioners who are seeking

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