

**RAFAEL AUGUSTO SEIXAS REIS DE PAULA**

**Borrowing resources for radical innovation projects: an  
organizational contribution for the understanding of the  
Innovation Function**

São Paulo

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Innovation Function**

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### **Abstract**

This dissertation is focused on answering the following question. **How do firms integrate the Innovation Function to borrow resources for radical innovation projects?** This question is relevant and, as noted by the literature review, this debate is still in its early stages and does not detail how the Innovation Function (IF) might borrow resources. Therefore, this dissertation attempts to make a deeper understanding of the attributions of the IF and the resources required for radical innovation projects.

The literature highlights the existence of the IF, which is an organizational function focused on identifying, structuring, nurturing and managing the portfolios of radical innovation projects. Radical innovation projects are relevant, for instance, to the exponential growth of firms or the creation of new markets. However, these projects are fraught with uncertainties, and initially defining what, when and how many resources are necessary might not be possible. Besides, many resources may already exist in the parent firm or will be used only a few times, and so there is no need to duplicate them. It is neither possible nor intelligent to IF possess all the resources for radical innovation projects.

The IF, in this way, can borrow resources (e.g., human resources, laboratories resources, pilot plant) from, for example, Business Units, R&D or Engineering departments. Then, borrowing resources within the parent firm is a suitable alternative for IF to nurture radical innovation projects. To develop the capacity to borrow these resources, the IF should be integrated within the parent firm. This aspect brings us back to the classic authors of organizational theory, who demonstrate that an organizational function is differentiated from other functions, but must be integrated to achieve the firm's goals. The classic theoretical anchorage opens up an important avenue of research.

This dissertation aims to go beyond the current studies on differentiation and integration within innovative established firms. The literature has pointed out that top management teams (e.g., senior teams) or the existence of the product champion ensure the necessary integration. In order to conduct the empirical research, this dissertation considers that these aspects discussed by the literature are necessary, but not sufficient to answer the research question.

This dissertation adopted an inductive study using multiple case research design, considering three established firms in different industrial sectors. The findings of the case studies reveal four different approaches for borrowing resources, which require different struggles of the IF. Besides, the results acknowledge that instead of the prior destination of resources for radical innovation projects, or merely the existence of product champions and the high organizational level support, IF need to be able to struggle to borrow resources. Furthermore, to each struggle, the findings also reveal different integration actions to be carried out by the IF and the existence of integrators' role to borrow resources for radical innovation projects.

**Keywords: radical innovation; innovation function; resources; innovation management.**



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## 1. Introduction

Exponential growth is an essential concern for most established firms and one of the most critical challenges facing senior executives. As pointed out by O'Reilly and Tushman (2016), Govindarajan and Trimble (2005) and O'Connor et al. (2008), there are many examples of firms, which, before the depletion of their traditional business, could achieve exponential growth by exploring new business opportunities<sup>1</sup> while simultaneously exploiting their current business (e.g., IBM, Cisco, Ciba Vision, Flextronics, Hewlett Packard, Corning Microarray Technologies, DSM, Sealed Air, General Electric, Procter & Gamble, DuPont).

The established firms, as explained by O'Connor et al. (2008) and O'Connor and DeMartino (2006), are large firms, leaders in a variety of mature markets and have generally achieved operational excellence through continuous cost-reduction programs. They also point out, that many established firms have declared a strategic intent to escape the intense competition of current markets, seeking exponential growth beyond conventional new product development that leads to incremental changes in existing product lines.

There is a vast literature explaining how established firms achieve exponential growth, including books by Govindarajan and Trimble (2005), O'Connor et al. (2008, 2018), and also papers such as those of O'Connor (2008), Raisch et al. (2009), O'Reilly and Tushman (2013), Hill and Birkinshaw (2014) and Benner and Tushman (2015). Despite the specificities of these books and scientific papers, they have a central point in common: in order to obtain exponential growth over the long term, firms should continuously and systematically develop radical innovation projects.

As stated by O'Connor et al. (2008), radical innovation helps firms to stand out from the competition, enables rapid growth, and creates a high return on investment. Radical innovation projects create such a dramatic change in processes, products, or services that they transform existing markets or industries, or create new ones. O'Connor et al. (2008) also argue that exponential growth of firms can occur organically through the development of these

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<sup>1</sup> In this dissertation, new business opportunities do not refer to exploring new markets, by adopting current products or services or developing incremental innovations. In some industrial sectors, such as the electronics and automotive, an established firm explores its current products in new markets (a new country, for instance), adopting similar products or by promoting incremental customization. However, in this dissertation, exploring new business opportunities refers to creating new markets by developing radical innovations.

projects rather than just acquiring firms, merging with other firms, investing in startups, or promoting spinoffs.

According to O'Connor et al. (2008) radical innovation is defined as products and technologies that have a high impact on the market in terms of offering (1) wholly new benefits; (2) significant (i.e., 5 to 10 times) improvement in known benefits; or (3) significant reduction (i.e., 30 to 50%) in cost. However, in this dissertation, the radical innovation concept is understood as an extended perspective (O'Connor, 2008), including radical innovation *stricto sensu* (O'Connor et al., 2008) and also really new innovation (Garcia & Calantone, 2002; O'Connor, 2008).

Garcia and Calantone (2002), and O'Connor (2008) consider that radical innovation *stricto sensu* is extremely rare, while many innovation projects imply technical or market discontinuities but will not incorporate both and do not fit into the narrow definition of radical innovation. They call this type of innovation as “really new innovation”. Based on O'Connor's (2008) arguments, both really new innovation and radical innovation *stricto sensu* share levels of uncertainty in multiple dimensions. However, the difference is one of degree (i.e., uncertainties may be even more extreme or exist in more dimensions for radical innovation than for really new innovation). For the purposes of this dissertation, really new innovation and radical innovation *stricto sensu* are treated together as the extended perspective and labeled as just “radical innovation”<sup>2</sup>.

As stated by O'Connor et al. (2008), the continuous and systematic development of a radical innovation project means that the development requires the establishment of a systemic model, integrated with the routine activities of the firm, and a mission to make this development perennial. That is, it is not dependent on sporadic resources, on attracting the occasional interest of specific people linked to the leadership over a short period; and it is also no longer treated as an unofficial project.

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<sup>2</sup> This dissertation is interested in the high uncertainty innovation projects, despite their many different definitions, such as strategic innovation (O'Connor, Corbett, & Peters, 2018), disruptive (Christensen, 1997), discontinuous (Veryzer, 1998), breakthrough, game-changers, and others. For more details, see for example Garcia and Calantone, (2002), there are more than fifty different classifications for the term innovation, most of them refer to high uncertainty innovation. Our main concern focuses on the fact that the high uncertainty innovations need to be managed differently than the incremental innovations. As stated by O'Connor, Corbett and Peters (2018), all the radical innovations, even considering the extended perspective, require a completely different management approach from the one that executes along an operational excellence mentality, as the incremental ones.

For Govindarajan and Trimble (2005), O'Connor et al. (2008), Benner and Tushman (2015), the continuous and systematic development of radical innovation projects with the potential to deliver exponential growth for firms is not a simple matter. Birkinshaw, Zimmermann, and Raisch (2016) note that most firms frequently fail to develop radical innovation projects, and, as a consequence, these firms might become obsolete and even leave the market. They point out that recent examples of this phenomenon include Blockbuster, Eastman Kodak and Lehman Brothers.

McDermott and O'Connor (2002), O'Connor et al. (2008), O'Reilly and Tushman (2013) consider that the development of incremental innovation projects is already dominated by numerous firms, while the continuous and systematic development of radical innovation projects demands considerable effort. These papers highlight that it is difficult for firms to get appropriate support for radical innovation projects, where the internal culture and pressures often push efforts toward projects with lower risks and/or immediate rewards as in the case of incremental innovation projects.

In this way, O'Connor et al. (2008), Tushman et al. (2010), O'Reilly and Tushman (2013), Govindarajan and Trimble (2005), Raisch (2008) defend the presence in the firms of specific organizational forms to promote the continuous and systematic development of radical innovation projects. By organizational form, we consider the multiple possibilities of division and coordination of labor inside the firm, as noted by Mintzberg et al. (2006). As a solution, O'Connor et al. (2008) defend the Innovation Function (IF)<sup>3</sup> as an organizational function. The IF concentrates a primary group of activities: it has its own core body of knowledge, hierarchy, leadership, location in the organizational chart, goals, and deliveries. This dissertation considers that IF is separated from the ongoing mainstream operations and, mainly, from the research and development, marketing and new product development process of the parent firm<sup>4</sup>. IF aims to manage radical innovation project portfolios<sup>5</sup> to build up the capabilities necessary to

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<sup>3</sup> This dissertation standardizes the term "Innovation Function" as "IF".

<sup>4</sup> The terms "parent firm" or "parent organization" are treated here as similar. They are related to a differentiated structure between exploiting ongoing mainstream operations and the organizational form responsible for exploring new opportunities, knowledge, and innovation projects. In some papers, such as Heracleous et al. (2017), we can find the term "broader organization" as similar to our understanding of parent firm or parent organization.

<sup>5</sup> In this dissertation "Portfolio" means a collection of projects that are grouped together to facilitate the effective management of the work to meet strategic business objectives (PMI, 2006).

systematically and continuously develop radical innovation (O'Connor et al., 2008; O'Connor, 2012; Bagno, Salerno, & Dias, 2017; Salerno & Gomes, 2018).

According to O'Connor (2012), the Innovation Function is “*an organizationally recognized group with responsibility and accountability for a specific mission of the company. In this case, the mission is major innovation, meaning innovation that is path-creating rather than path-dependent, and that offers new growth platforms for the company and wholly new benefits to the market*” (O'Connor, 2012, p. 361). As stated by Salerno and Gomes (2018), the mission of the group of the IF is to identify, structure, nurture and manage the portfolio of radical innovation projects. In this case, according to Slater, Mohr and Sengupta (2014), managing a radical innovation portfolio demands the capabilities to evaluate, select, and prioritize radical innovation projects, continuously updating and revising the projects, accelerating the most prominent projects, searching for resources for them, and freezing or deprioritizing the non-prominent ones.

This dissertation adopts *resource* as a concept from Barney (1991), meaning physical capital resources (e.g., firm's plants, laboratories, equipment), human capital resources (e.g., experience, know-how), and financial resources for the project development. As pointed out earlier, radical innovation projects are essential for long-term exponential growth; however, the projects demand resources from the parent firms. As consequence, O'Connor et al. (2008), O'Reilly and Tushman (2008), Burgers et al. (2009), Turner, Swart, and Maylor, (2013), Salerno and Gomes (2018) show that an established firm needs the capacity to mobilize internal resources for radical innovation projects.

Leifer et al. (2000), O'Connor et al. (2008), and O'Reilly and Tushman (2016) discuss numerous examples of the development of radical innovation projects, which, in most cases, require a long development period, impossible to determine in the initial stages of development but may be more than a decade, with changes in the project leaders, sponsors, and funding (leadership from the business units or the corporate levels).

To deal with these specificities, Griffin et al. (2014), Jansen et al. (2009) and Birkinshaw, Zimmermann, and Raisch (2016) clarify the importance of a high level sponsor and/or the presence of the product champion. Bagno (2014), and O'Connor, Corbett and Peters (2018), however, state that in most established firms some people need to circumvent the formal management routines to develop radical innovation projects. In this situation, the radical



innovation projects are treated as unofficial until they achieve substantial results and importance in the firms. Besides, Kelley (2009) remembers that it is common decelerating or even canceling of the initiatives to boost radical innovation projects. Then, O'Connor et al. (2008) state that IF has a hard attribution to accomplish the necessary resource allocation for radical innovation projects throughout all their development activities.

In this way, the term “borrow resources” brought by Govindarajan and Trimble (2005) gains relevance. In this dissertation, “borrow resources” refers to the need for the IF to obtain internal resources (e.g., financial, human resources, infrastructure, such as equipment and laboratories) within the parent firm for the development of radical innovation projects.

Since IF deals with radical innovation projects, the discussion on borrowing by Govindarajan and Trimble (2005) can be extended to IF (IF borrows resources to projects). In this dissertation, the construct “borrow” is adopted, for example, when within the firm is the owner of the resource (a Business Unit, for instance) that can lend a resource (e.g., pilot plant) to the development of a radical innovation project for a determined period. The main premise is that IF does not have all the necessary resources previously for developing radical innovation projects. Actually, it is not possible to determine the resources necessities, for example, at the beginning of the project development.

As explained by O'Connor and Rice (2013) and Salerno and Gomes (2018), radical innovation projects are fraught with uncertainties, and initially defining what, when and how many resources are necessary might not be possible. Furthermore, Salerno and Gomes (2018) point out that many resources may already exist in the parent firm or will be used only a few times, and so there is no need to duplicate them. It is neither possible nor intelligent to IF possess all the resources for radical innovation projects. Then, borrowing resources within the parent firm is a suitable alternative to IF. Hence, the IF is considered an organizational function, which needs to be integrated into the parent firm to borrow resources for radical innovation projects.

This aspect brings us back to the classic text of Lawrence and Lorsch (1967), who show that an organizational function is differentiated from others but must be integrated to achieve the firm's goals. This classic theoretical anchorage opens up an important avenue of research. Despite this importance in the literature, the discussion is still beginning and does not explore in detail how the Innovation Function might borrow resources from the parent firm for radical innovation projects.

This dissertation argues that it is essential to go beyond to the current studies on differentiation and integration within ambidextrous established firms (e.g., Tushman and O'Reilly, 1996 and Jansen et al. 2009). The literature has pointed out that top management teams (e.g., senior teams) or the existence of the product champion ensure the necessary integration across parent firm and its exploratory organizational forms. Here, one of the arguments is that structural ambidexterity (Tushman & O'Reilly, 1996) is necessary, but not sufficient to permit the integration of IF to borrow resources for radical innovation projects.

Besides, there are many indications in recent papers for in-depth analysis of integrating internal perennial organizational forms (such as the IF) to borrow resources for radical innovation projects.

- Existing research does not tell us the operational nuances of how to integrate intra-firm units to boost high uncertainty innovation project development. The debate has only outlined a general picture of what elements the integration process entails. (Chen & Kannan-Narasimhan, 2015).
- What seems to be still lacking are qualitative studies at the micro level, that would allow organizational integration within innovative established firms (Cantarello, Martini, & Nosella, 2012).
- The literature might extend the focus on considering how exploration and exploitation yield resources that are valuable, rare, difficult to imitate and substitute can offer new insights into the sources of resource-based view (Wilden et al. 2014).
- There is little evidence about the role of structural differentiation and integration in ambidextrous organizations (Jansen et al., 2009).
- Although researchers have started to uncover contexts of differentiation and integration, our understanding of how innovative organizations may pursue organizational integration is far from complete (Burgers et al., 2009).
- Little has been demonstrated regarding organizational integration to boost radical innovation project development (Turner, Swart, & Maylor, 2013).

In this way, this dissertation discusses the following question: **How do firms integrate the Innovation Function to borrow resources for radical innovation projects?**

A core assumption considers that the IF needs to be separated but also integrated into the parent firm. In this way, this dissertation offers a granular perspective on how integration might take place. In this way, one of the propositions of this dissertation state that the integration mechanisms, as appointed by the classics authors - Lawrence and Lorsch (1967), will be relevant, if they were adopted to the IF to face the struggles to borrow resources.

Furthermore, this dissertation follows research suggestions made by O'Connor (2012) and O'Reilly and Tushman (2013). O'Connor (2012) ask how the IF should be resourced? O'Reilly and Tushman (2013) call for more insights into the nature of managerial capability to achieve ambidexterity, as well as more inductive research on how leaders may orchestrate the allocation (and reallocation) of resources between old and new business domains. In light of the above, this dissertation has the following objectives:

**General objective:**

Explain how the Innovation Function is integrated within the parent firm to borrow resources for radical innovation projects.

**Specific objectives:**

Identify the integration practices of the Innovation Function to borrow resources.

Explain how the different integration practices contribute to borrowing resources.

Establish categories of borrowing resources by the Innovation Function.

In order to achieve these aims, an inductive study inspired by Eisenhardt (1989), Voss, Tsikriktsis and Frohlich (2002), and Yin (1994) was carried out, using multiple case research design in three Brazilian firms. Considering the characteristics of the innovations generated by the established firms operating in Brazil, where there is the predominance of commoditized or tropicalized products and/or with a lower degree of technological disruption or creation of global markets, it may make sense to consider radical innovation in its extended perspective, not just in the stricto sensu definition. The extended perspective would not be problematic and would be closer to the reality of the Brazilian firms, without moving away from the essence of the research question (to be discussed below).

The findings from the case studies reveal four different approaches to borrowing resources, which require different integration efforts from the IF. The findings also demonstrated that for

each approach to borrowing resources there are the struggles of the IF. In this dissertation, struggle means the IF team activities to deal with the side effects or overcome the barriers of each approach<sup>6</sup>. This dissertation coined the term “approach to borrowing resources” as an important construct, which could contribute to explain what type of struggle and how the struggles influence each approach. To each struggle, the findings also reveal different integration actions to be carried out by the IF and the existence of integrators’ role to borrow resources for radical innovation projects.

The dissertation contains six chapters. This introduction is followed by the literature review, of works on structural ambidexterity and the IF, anchored in the theoretical discussion on organizational integration, including revisiting the classic authors and an in-depth analysis of the current debate. The third chapter describes the methodological aspects. The fourth describes the case studies, and, following Eisenhardt’s (1989) suggestions, three different categories were adopted: i) description of the IF chart and project portfolios for each firm; ii) reasons why the IF needs to borrow resources for each firm; and iii) identification of the integration practices for the IF borrowing resources for each firm. The fifth chapter discusses the case similarities and differences and compares the data with conflicting and similar literature. This comparison reveals two relevant findings. First, there are different approaches to borrowing resources. The research found four approaches. Second, each approach generates side effects for the IF’s efforts to borrow resources. Then, IF needs to deal with or avoid the side effects. Furthermore, the fifth chapter ends with the integration practices of the IF and the validation of the propositions. The sixth and final chapter focuses on the conclusions.

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<sup>6</sup> For more details of the side effects and barriers, see topic 5.3 (from pages 157 to 162). This dissertation consider as side effect a possible secondary, typically undesirable effects, or possible unwanted consequences caused by each approach to borrow resources for radical innovation projects. The barriers can be internal or external to the firms. According to Sandberg and Aarikka-Stenroos (2014) the internal barriers originate within a firm and vary, according to the contingent to its management and organization. External barriers originate from a firm's external environment and emerge when a firm interacts with other organizations or actors in economic and innovation systems; these include issues relating to, for example, the behavior of competitors, customers, partners, and governments.

## **2. Literature Review**

The literature review consists of the discussions on structural ambidexterity and the Innovation Function. The structural ambidexterity discussion includes a vast range of literature, from the first studies by March (1991), Duncan (1976) and especially O'Reilly and Tushman (1996). These papers opened, as discussed below, many scientific research fields. The second discussion, focused on Innovation Function, coined by Gina O'Connor and her team of colleagues at RPI, Rensselaer Polytechnic Institute. Since the nineties they have been conducting a longitudinal study of established firms who want to build capabilities to continuously and systematically develop and commercialize radical innovation projects.

To provide the theoretical anchor of these discussions in order to answer the research question, this dissertation analyzed the literature on organizational integration. This includes a revisiting of the classic authors and an in-depth analysis of the current discussion of this literature. Bibliometric and content analysis were adopted to explore the ongoing discussion. The main findings of the current literature examine the main journals and papers, the communities of researchers about the practices to integrate organizational functions to boost radical innovation project development, and the main criticisms of the classics and current literature.

This chapter is therefore divided into an initial description of the structural ambidexterity and the IF. Then, the problems of the IF in terms of organizational integration are discussed. The third part of the literature review revisits classic authors, and the fourth describes the perspective from the current debate. This chapter highlights the main criticisms of the literature. The fifth part comprises the main findings from the literature review. This chapter finishes with the discussion of the propositions and the announcement of the conceptual model.

## 2.1. Structural Ambidexterity and the Innovation Function

Several scholars have argued that firms in dynamic markets should pursue dualities, which require them to plan, project, implement and manage activities in new ways (e.g., Tushman and O'Reilly, 1996). Govindarajan and Trimble (2005), Raisch (2008) and O'Reilly and Tushman (2013) explain that such dualities are related to the concept of organizational ambidexterity. As noted by O'Reilly and Tushman (2008), organizational ambidexterity is a dynamic capability that permits the firms to identify opportunities and threats and reconfigure assets (people, infrastructure and financial resources) to allow simultaneous exploitation (competing in mature markets and technologies, typically through competence-enhancing changes) and exploration (competing in new technologies or markets, often with competence-destroying changes). Initially based on Duncan (1976), the growing research stream on ambidexterity has focused on understanding how firms manage capabilities with competing objectives, such as exploitation and exploration (e.g., Govindarajan & Trimble, 2005; Raisch, 2008; Tushman et al., 2010; Van Burg et al., 2012; O'Reilly & Tushman, 2013).

Raisch and Birkinshaw (2008), Govindarajan and Trimble (2005), O'Connor and DeMartino (2006) acknowledge structural ambidexterity as an aspect derived from the organizational ambidexterity literature. For Tushman and O'Reilly (1996), structural ambidexterity is the establishment of an organizational form<sup>7</sup> within the parent firm but is separated from the ongoing mainstream operations and, mainly, from the research and development, marketing and new product development process of the parent. It involves placing exploration and exploitation activities into different organizational units. Structural ambidexterity focuses on exploring new markets, products, knowledge, and business opportunities. As noted by O'Reilly and Tushman (2013) and Govindarajan and Trimble (2005), the ongoing mainstream operation focuses on achieving the short-term objectives of the firm, ensuring efficient operations in exploiting the existing business, knowledge, markets or products.

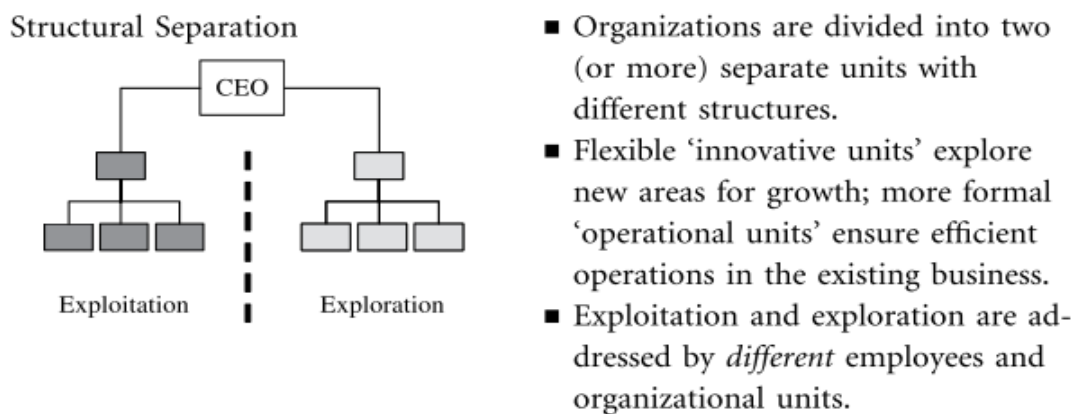
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<sup>7</sup> An organizational form is considered here as similar to an organizational structure or organizational unit. As mentioned in the introduction, by organizational form we consider the multiple possibilities of division and coordination of labor inside the firm, as noted by Mintzberg et al. (2006).

Tushman and O'Reilly (1996) point out that a separate organizational unit makes it possible to also focus on long-term objectives and requires specific tasks, cultures, team members competencies, structure, appropriate business performance evaluation criteria, incentives and a reward system.

The basic idea of the structural separation comes from March (1991), who distinguishes the concepts of exploitation and exploration. Exploitation refers to the organizational learning to refine or expand existing products or processes whereas exploration involves organizational learning to create fundamentally new products, knowledge, processes, or market spaces. Skills, processes, and mindsets associated with exploration differ significantly from those associated with exploitation. Many other researchers follow this argument (e.g., Heracleous et al., 2017; O'Reilly & Tushman, 2013; Tushman et al., 2010; Jansen et al., 2009; Raisch, 2008). Figure 1, adapted from Raisch (2008), offers an overview of the structural ambidexterity perspective and its main characteristics.

**Figure 1 - Characteristics of the structural separation**



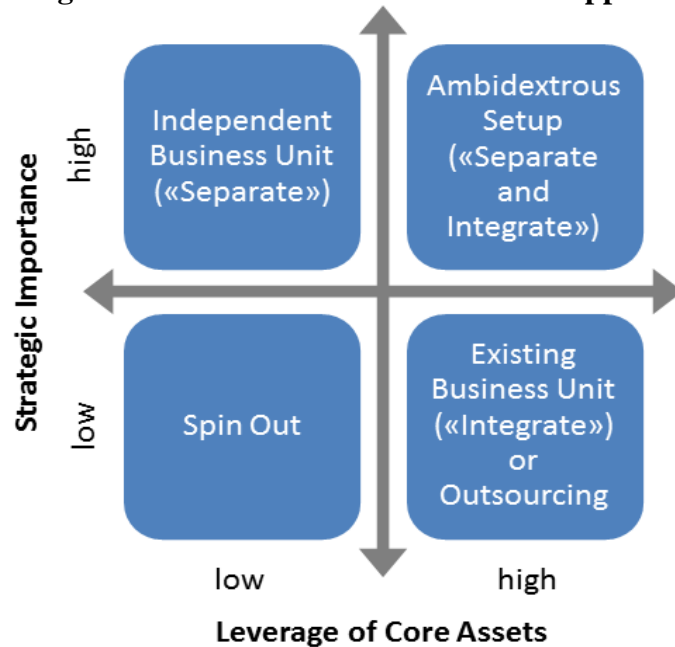
Source: Raisch (2008)

Raisch and Birkinshaw (2008), and Raisch (2008), based on classic authors from organizational theory such as Burn and Stalkers, point out that efficient exploitation of the existing business, markets, knowledge or products has been related to a mechanistic organization form, relying on standardization, centralization, and hierarchy. However, exploitation hinders the forces of innovation and flexibility required for exploring new breakthrough business opportunities. On the other hand, exploration is better supported by

organic structures with high levels of decentralization, but these structures have been found to impede coordination and efficiency.

O'Reilly and Tushman (2016) state that exploration opportunities mostly address a firm's growth or future business and can be assigned to middle and long-term innovation project portfolios. These opportunities can leverage existing firm assets to gain a competitive advantage. They point out that these assets mainly consist of competencies, customer base, sales and marketing channels, manufacturing, technology platforms or brands. Furthermore, they argue that the ambidextrous approach is appropriate for specific contexts, as indicated in Figure 2.

**Figure 2 - Context of the ambidextrous approach**



Source: adapted from O'Reilly and Tushman (2016)

The argument of O'Reilly and Tushman (2016) refers to the differentiation discussed by Lawrence and Lorsch (1967). This classic text from the sixties states that each organizational unit is configured according to its task environment's specific requirements. Empirical research asserts that ambidextrous separation is associated with a firm's high performance in terms of increasing the market share and the creation of new markets (Tushman et al., 2010), the gain in revenue and profit growth (He & Wong, 2004), and customer satisfaction (Slater, Mohr, & Sengupta, 2014).



Considering the structural ambidexterity perspective, O'Connor et al. (2008), Tushman et al. (2010), O'Reilly and Tushman (2013), Govindarajan and Trimble (2005), Raisch (2008) defend the presence of a specific organizational form to continuously and systematically promote the development of radical innovation projects. These papers point out that most established firms have a separate organizational form from the ongoing mainstream operations of the parent firm.

The structural ambidexterity literature (e.g., Tushman & O'Reilly, 1996; Benner & Tushman, 2003; Raisch, 2008; Jansen et al., 2009; O'Reilly & Tushman, 2013) highlights different and combined elements for ambidexterity firms to be successful, such as: (i) the definition of a clear strategic goal to justify the need for ambidexterity; generally, the new radical innovation projects must be strategically important, in line with the firm's strategy, and close to its core business to exploit the synergies of skills, technology, manufacturing processes, marketing, sales, branding, and channels; (ii) the commitment of managers to feed new projects and protect them from those that are not favorable to new business; (iii) the separation of traditional businesses (exploitative business), so that the new ones can develop an organizational alignment and simultaneously take advantage of the resources and capabilities of traditional businesses; (iv) clear decision criteria or the incorporation of the new businesses back into the organization; (v) the definition of a common identity based on vision, values, and culture shared between the old and new business units.

This dissertation, despite the importance of these different and combined elements, argues that just following them is not enough to systematically develop radical innovation projects. Hill and Birkinshaw (2014) and Burgelman and Valikangas (2005) indicate that many ambidexterity firms have discontinued such separate organizational forms. In this way, this dissertation assumes that ambidexterity is not enough, when the exploratory efforts are not consolidated in an organizational function, as the Innovation Function (IF).

As a solution, O'Connor et al. (2008) defend the IF as an organizational function, which is an appropriate organizational form to deal with these requirements. According to O'Connor (2012), the IF is *“an organizationally recognized group with responsibility and accountability for a specific mission of the company. In this case, the mission is major innovation, meaning innovation that is path-creating rather than path-dependent, and that offers new growth platforms for the company and wholly new benefits to the market”* (O'Connor, 2012, p. 361).

As stated by Salerno and Gomes (2018), the mission of the IF team is to identify, structure, nurture and manage the portfolio of radical innovation projects. The IF is separated from the ongoing mainstream operations of the parent firm and, mainly, separated, for example, from research and development and marketing functions and new product development activities (O'Connor et al., 2008; O'Connor, 2012; Bagno, Salerno & Dias, 2017, Salerno & Gomes, 2018).

Research and development (R&D) and marketing functions and new product development (NPD) process can be related to the development of radical innovation projects. However, as appointed by Salerno et al. (2016), IF differs from them. Unlike, NPD, R&D, and Marketing, IF goals include managing radical innovation portfolios, boosting the creation of new businesses platforms, caring the integrated development of technology, product and market, and also innovation can influence strategic intents. The table 1 highlights the main differences between IF and NPD, R&D and Marketing.

**Table 1 - IF differentiation features – a comparison with NPD, R&D, and Marketing**

| <b>Characteristics</b>   | <b>IF</b> | <b>NPD</b>   | <b>R&amp;D</b>  | <b>Marketing</b>  |
|--|-----------|--|---|---|
| <b>The management of a radical innovation portfolio</b>                      | Yes       | No. NPD does not manage portfolios, it develops projects | No. R&D manages and develops a portfolio of projects for the developing of technologies, not products. Moreover, some technologies may turn into incremental innovations, not necessarily radical ones. | No.   |
| <b>Influences strategic intents</b>  | Yes       | Normally not. It can happen, but it is not a mandate.    | It can happen indirectly, if the technology developed turns into a new business platform.   | Maybe. Most of the work is related to traditional businesses. |
| <b>Deals with the creation of new businesses platforms</b>                   | Yes       | No.  | No. It develops technologies, not businesses. Technologies can help in the development of new businesses, but this development.   | No. It can help, but is not the primary mandate.              |
| <b>Cares of the integrated development of technology, product and market</b> | Yes       | No. NPD does not develop technologies nor markets        | No. R&D develops technologies, not products or markets  | No. It can help the development of a market.                  |

Source: Salerno et al. (2016)

The IF, like any organizational function, has its own set of activities, its own core body of knowledge, hierarchy, leadership, location in the organizational chart, goals, and deliveries. This dissertation argues that structural separation (as structural ambidexterity) is a necessary condition, but not sufficient in itself, to allow the established firms to continuously and systematically develop radical innovation projects.

O'Connor et al. (2008) defend that the IF team is necessary to nurture and manage a radical innovation project portfolios. Bagno (2014) argues that a radical innovation project does not take place inside IF domains, and neither is the IF the place in the firm where “innovators” are gathered. The IF typically takes on a permanent role of an innovation catalyst or facilitator between the other instances (e.g., C-Level, different business units, external partners of the firms, other organizational functions such as Marketing, Research and Development, Commercial, Engineering).

To deal with this situation, O'Connor et al. (2008), O'Connor (2012), Kelly, Peters, and O'Connor (2009), Kelly et al. (2001), Salerno and Gomes (2018) emphasize the need to continuously and systematically build exploration capabilities. Thus, in order to be successful, the firms must have a management system to support the IF, and this system includes a set of elements: mandate and responsibilities, structure and process, resources and skills, leadership and governance, and metrics and reward systems (O'Connor et al., 2008). Like any management system, one element does not achieve the expected results, unless the other elements perform well. These elements are described according to table 2. Based on O'Connor et al. (2008), this table also shows the difference between the innovation management system and the ongoing mainstream operations.

**Table 2 - Comparison of mainstream operation and innovation management system**

| <b>Elements</b>               | <b>Description</b>  | <b>Ongoing mainstream operations management system</b>            | <b>Innovation management system</b>  |
|-------------------------------|---|---|--------------------------------------|
| <b>Objectives and mandate</b> | Definition of the purpose and responsibilities of the system                  | Efficient, effective management of current markets and operations | New business creation in new markets |
| <b>Leadership and culture</b> | Rules about who are the responsible for the decisions, who are involved, etc. | Planning and delivery oriented                                    | Learning and building oriented       |

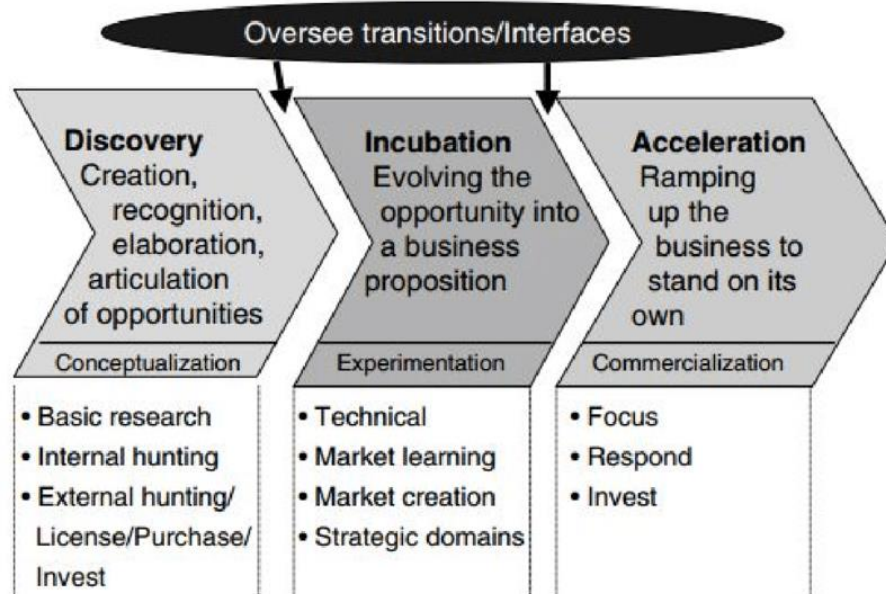
|                                       |   |  |   |
|---------------------------------------|---|--|---|
| <b>Structure</b>                      | Definition of the group responsible, whom it reports, its hierarchy, how it is formalized, etc.                               | Clear and delineated   | Flexible  |
| <b>Process</b>                        | Establishment of how the innovation projects are oriented   | Stage-gate, project management oriented, avoid deviations from budget and schedule     | Learning and experimentation oriented   |
| <b>Governance and decision making</b> | Rules about how decisions are made  | Go-or-Kill criteria clear in advance, hierarchical decision making                     | Decisions made based on strategic intent and continued learning; criteria not clear in advance; governance rather than hierarchy      |
| <b>Skills and talent development</b>  | Settlement of the type of abilities and talents needed, definition of roles and responsibilities                              | Functional Expertise   | Entrepreneurial expertise   |
| <b>Resources</b>                      | Resources for the projects  | Annual allocation – self funded, generally expected to generate return beyond expenses | No-predefined resources dedication  |
| <b>Metrics and reward system</b>      | Rules and assessment criteria to analyze the system's performance and the reward system for those operating within the system | On-time delivery, cost containment, profitability                                      | Portfolio health and balance, connection with strategic of the firm, new domain accessed, new resources garnered, new business starts |

Source: Based on O'Connor et al. (2008)

O'Connor et al. (2008) propose the development of different capabilities, consisting of three distinct building blocks necessary for an IF performance: Discovery, Incubation, and Acceleration. Each building block differs substantively from the activities of ongoing

mainstream operations. Figure 3 offers an overview of the discovery, incubation and acceleration capabilities and their interfaces.

**Figure 3 - DNA Model - The building blocks of breakthrough innovation capability**



Source: O'Connor et al. (2008)

To sum up, according to O'Connor et al. (2018), the three building blocks can be described as:

**Discovery:** discovery competency is a firm's ability to create and identify opportunities that may have a major impact in the marketplace through the delivery of new performance benefits, greatly improved performance, or new ways of doing business. The opportunities can come from technology push or market need. They can originate from within or outside the company.

Discovery refers to creating, recognizing and elaborating new breakthrough business opportunities, based on radical innovation project portfolios. To carry out the discovery building block, the IF requires exploratory skills, including both scientific discovery, the external hunting for business opportunities, and the skills to connect disparate bits of scientific and market trend information to describe a compelling opportunity.

Different authors discuss these exploratory skills related to the discovery competence. Leifer, O'Connor, and Rice (2001) point out that a crucial premise for discovery competency

is the ability to find within the firms experienced people that can contribute to seizing new business opportunities. Aloini et al. (2013) discuss the necessity to hunt from within the firms experienced people, especially at the beginning of radical innovation project development. Hunting experienced people can help radical innovation project teams connect with other people when new knowledge or insight is needed. Agostini, Nosella and Filippini (2016), Bessant (2008) and Gassmann, Widenmayer, and Zeschky, (2012) add a significant contribution by mentioning the importance of hunting internally experienced people. They defend the implementation of personal ties to spread radical innovation throughout the firm by addressing potential internal stakeholders and innovation champions. According to O'Connor et al. (2008), the discovery also includes invention as well as accessing the inventions of others, external to the firm. The former requires a strong R&D capability, and the latter includes hunting both inside and outside the boundaries of the firm ideas and opportunities and licensing technologies or investing in promising startups. Furthermore, discovery requires funding opportunities through universities, venture capital investments, or strategic alliances.

**Incubation:** As stated by O'Connor et al. (2008) "*incubation is a business laboratory. It's the ability to experiment with technology, or discovery and business concepts and models simultaneously to arrive at, for any single project, a demonstrated model of a new business that brings breakthrough value to the firm*" (O'Connor et al. 2008, p.84). Incubation capability matures breakthrough business opportunities, which have been discovered early, into business proposals. A business proposal is a working hypothesis about what technology could make possible in the market, what the market space will ultimately look like, and what the business model will be. Incubation is not complete until this proposal (or, more likely, many different proposals, based on the initial discovery) has been tested in the market, with a working prototype. Incubation requires experimentation skills, which are used not only on the technical front, but also for market learning, new market creation and to test the business proposal's match with the firm's strategic intent. As O'Connor et al. (2008) state, in most innovation project portfolios the vast majority of projects entering the incubation phase are filtered out as the incubation experiments are conducted, due to the high uncertainty associated with what initially appeared to be a promising opportunity but which ultimately fails to prove out. As a consequence, O'Connor et al. (2008) demand conduct prototyping exercises and the testing of new market assumptions, hypotheses, and concepts.

The literature also complements several aspects pointed out by O'Connor as necessary for incubation. Conducting prototyping exercises and testing new market assumptions, hypotheses and concepts are also discussed by other authors, who add essential elements related to incubation competencies. Bohlmann et al. (2013) suggest that the firms interested in testing assumptions, hypotheses and concepts establish customer contacts through a combination of tactics to examine the firm's understanding of requirements. Particularly, for more radical innovation these aspects are more difficult for customers to visualize. Berchicci and Tucci (2010), Leifer, O'Connor and Rice (2001) and Arrighi, Masson, and Weil, (2015) point out that these testing attempts are far from easy, mainly for established firms which aim to develop radical innovation projects. Leifer, O'Connor, and Rice (2001) highlight some suggestions, such as connecting external stakeholders, as early-adopter partners, manufacturing partners, technology-development partners and funding partners. Bohlmann et al. (2013) defend a combination of tactics to test the firm's understanding of needs, particularly for more radical innovation where necessities are more difficult for customers to express.

**Acceleration:** For O'Connor et al. (2008), acceleration is the capacity *“to ramp up fledgling business to a point where it can stand on their own relative to mature business platforms and operation management's performance requirements in their existing business units or wholly new ones”*. (O'Connor et al. 2008, p.120). Whereas incubation reduces market and technical uncertainty through experimentation and learning and tests the organizational commitment to invest in the opportunity as a strategic growth area, acceleration focuses on building a business to a level of certain predictability concerning sales and operations. Acceleration involves exploitation rather than either exploration (which discovery requires) or experimentation (which incubation requires). The focus of acceleration includes investment for building the business and its necessary infrastructure, focusing on and responding to market leads and opportunities, and beginning to establish repeatable processes for typical business processes such as manufacturing and order delivery, customer contact, and support. Acceleration involves turning early customer leads into a set of qualified customers and predictable sales forecasts. Similar to an independent start up firm in first stage growth, acceleration pursues top line revenue rather than bottom line profitability.

As pointed out by O'Connor et al. (2008), despite what can be presumed in Figure 3 (page 30), DNA is not a process. The widely known stage-gate process for new product development (Cooper, 1993) is not adherent to the DNA Model. As pointed out by Griffin et



al. (2014), the new product development processes are typically depicted in the literature as linear processes having a certain number of predefined stages, each of which is completed by a cross-functional team. At the end of each stage, a management committee makes a decision as to whether the project will proceed to the next stage, be stopped, or be recycled through the previous stage to better complete some of the tasks or steps in the stage. The project development project proceeds stage by stage, until, for example, the product is launched onto the market.

The reason for the non-adherence is simple. O'Connor et al. (2008) state that during the DNA model it is not possible to predefine all the necessary activities (just macro activities, such as indicated: basic research, internal hunting, market learning) to develop radical innovation projects. Besides, it is not viable to predict the period necessary for project evolution within each building block. For example, Leifer, O'Connor, and Rice (2001) show a project can require more than ten years to correctly incubate.

O'Connor and DeMartino (2006), Leifer, O'Connor and Rice (2001) and O'Connor et al. (2008) demonstrate that it is possible to predetermine only a broad spectrum of general activities that can be adopted in each building block of the DNA Model. For example, one of the main activities to discover new business opportunities is to recognize and foreground them within the established firms. As Leifer, O'Connor, and Rice (2001) exemplify, it requires a hunting activity performed by experienced workers with technological and market expertise. *"I started looking through our research organization to uncover intellectual property that I could leverage into the marketplace. I was actively scanning and knew [that one scientist] had been running around evangelizing [the technology] for two or three years. He hadn't been able to build a case that got it recognized and funded, which is what I did"* (Leifer, O'Connor, & Rice, 2001, p. 106).

Another activity pointed out by O'Connor et al. (2008) is to create or evaluate novel technology or combinations of technology and foundational knowledge. In order to accomplish these activities, Chang et al. (2012) and Turner, Swart, and Maylor, (2013) mentioned some alternatives, noting that the firm can participate in technical forums and invite scientists to understand future perspectives better and to broaden the understanding of the future trends of technology, market competition, and new business opportunities. Or, as stated by Turner, Swart and Maylor, (2013), the firm might establish knowledge-sharing relationships with new and existing external partners.

It is easy to realize that it is just a broad definition of activities. There is no precision of the necessary inputs and the breadth of the firm's efforts. Furthermore, it is difficult to predefine the output of these activities accurately and, as a consequence, what is the next activity to be done. It is impossible to predict with a minimum of precision the time extension and the activities of radical innovation project development. Consequently, it is also impossible to predetermine the resources necessary for project development.

This does not denote any mismanagement of the IF performance but is rather, as O'Connor and Rice (2013) explain, the result of the existence of considerable uncertainties during the development of the radical innovation projects. They point out four categories of uncertainty in the management of these projects: resources, market, technology, and organization. Resources uncertainty includes different questions: what resources and competencies are required to complete the project tasks?; which of these are currently available?; how should missing resources and competencies be acquired — through internal development or partnering?; who are potential partners and how are partnerships formed?

In addition, as O'Connor, Corbett, and Peters (2018) point out, the Innovation Function is a vertical and hierarchical organizational function. At first glance, many criticisms arise when considering vertical and "hierarchy" and its derivative terms, such as hierarchical, to deal with the IF. For example, Volberda (1999) argues that vertical structures severely hamper the ability to respond to firms to deal with innovative projects, especially when dealing with strong external market competition. Non-hierarchical organizational forms, by contrast, can respond to a wide variety of changes in the competitive environment in an appropriate and timely way (Volberda, 1999). Furthermore, Graetz and Smith (2009) believe verticality and hierarchy are welcome in an environment that is relatively predictable, but they are no longer sufficient in a complex and highly competitive environment.

However, for O'Connor, Corbett, and Peters (2018) innovation tasks and responsibilities, as in the IF, should be more vertically articulated. Consequently, firms can better build their DNA capabilities. For example, internal networks and communication flow would be made more accessible rather than more difficult. They argue that vertical structures and hierarchy are necessary to ensure the alignment of the IF with the firm's strategy and the ongoing mainstream operations. For example, the hierarchy, provided by the IF, can provide clear decision-making and strategic guidance and can also boost the necessities for different types of integration mechanisms.

Galbraith, Downey, and Jones (2011) also point out that vertical structures provide the clarity and sense of stability that people need in established firms, furnishing a basis for goal setting, reporting, and performance management. Furthermore, as O'Connor, Corbett and Peters (2018) state, the vertical structure can be efficient for the continuous and systematic development of radical innovation projects. However, it demands the integration of the IF with the parent firm.

## **2.2. Problems of the Innovation Function related to organizational integration**

O'Connor et al. (2008) argue that a successful IF performance requires rich integration within the current organizational functions of the established firms and external integration to achieve the resources necessary for the radical innovation projects. Adopting this premise, this dissertation argues that if the IF is not integrated the following problems might emerge:

- strategic misalignment: Hill and Birkinshaw (2014) assert that an organizational function can frequently be too exploratory, focusing on few projects perceived as being either too far from the firm's core business or too hard to integrate further into its operations,
- inability to use parent firm's resources: Iansiti, McFarlan, and Westerman (2003) admit that by "isolating" (not integrating) people, tasks, mandates, an established firm can inadvertently block them from using the firm's resources,
- failure of the parent firm to take advantage of the results: Heracleous et al. (2017) and Slater, Mohr, and Sengupta (2014) point out that the parent firm can underappreciate results generated by an isolated organizational function,
- difficulties in maintaining and attracting members to achieve long-term results: Raisch (2008) and Slater, Mohr and Sengupta (2014) argue that an isolated organizational function does not maintain and attract talented workers over time. The attraction is occasional according to a specific project's demand. When a project ends, the mobilization ends.

Furthermore, Benner and Tushman (2003) state that most established firms are not able to allocate resources to high uncertainty project portfolios such as those of radical innovation.

Tripsas and Gavetti (2000) observe a resource-based resilience to explore new opportunities, even in the case of leaders of innovative markets. In this way, Tushman et al. (2001), O'Reilly and Tushman (2011), Raisch (2008) and Birkinshaw, Zimmermann and Raisch (2016) highlight the necessity of resources from the parent firm to the separate organizational form, such as the IF as characterized by O'Connor et al. (2008). The existence of the IF assumes that firms need to “*to move into unchartered territory, where reliance on experience, current knowledge assets, and loyal customers is not an advantage*” (O'Connor, 2008, p. 315).

As noted by O'Connor and DeMartino (2006) and O'Connor et al. (2008), the continuous and systematic development of radical innovation projects requires a set of resources: financial resources, physical capital resources (the firm's plants, laboratories, equipment), and human capital resources from different backgrounds allocated within the established firms (marketing, research and development departments), and outside them (universities, suppliers, customers, co-developers).

Nevertheless, according to O'Connor et al. (2008) and Salerno and Gomes (2018), the IF might not possess all the necessary resources to allocate to radical innovation projects. The following reasons explain the difficulties for the IF to possess the resources.

- first: radical innovation projects are fraught with uncertainties. Initially defining what, when and how many resources are necessary might not be possible,
- second: many resources may already exist in the parent firm, and it does not make sense to duplicate them,
- third: most radical innovation projects require resources which can be used only a few times.

As assumed by Raisch (2008), Raisch et al. (2009), Jansen et al. (2009), O'Reilly and Tushman (2008) and Chen and Kannan-Narasimhan (2015), in many firms one of the key challenges is to leverage firms' existing resources for radical innovation projects. In this context, O'Reilly and Tushman (2008) and Teece (2006) highlight a critical factor for the long-term success of most firms in that these firms inevitably need to allocate resources to emerging radical innovation projects.

Burgelman and Valikangas (2005), O'Connor et al. (2008), and Kelley (2009) consider, however, that this allocation needs to be perennial. Support for radical innovation projects in

established firms often takes a cyclical path, where a firm fluctuates between endorsing these projects, then shutting them down but restarting them again after a few years. When the industry sectors or markets are growing firms may choose to invest in new radical innovation projects. However, when the core business faces a downturn in earnings, attention and resources may shift toward resolving short-term crisis. In other words, shifting the allocation of resources from radical innovation projects to incremental ones.

As O'Connor (2012) and O'Connor et al. (2008) state, even though there is a deceleration of resources for radical innovation projects in times of crisis, the IF does not disappear, just as the commercial, financial, and production do not.

Other researchers based on the resource-based view also complement this adverse scenario. Dougherty and Hardy (1996) observed that the inability of established firms to connect radical innovation projects to existing organizational resources is a crucial barrier. Besides, O'Connor, Corbett, and Peters (2018) clarify that the funding reasoning of traditional projects, fundamentally based on the annual budget allocation may be not appropriate for radical innovation project portfolios. When innovation is treated as a function, most firms allocate resources, which are granted on a project according to the project portfolio basis. However, if projects are viewed as highly promising, they become the glamour projects of the year, and the firm may throw too many resources at them. O'Connor, Corbett, and Peters (2018) believe that assigning a lot of resources to a project does not help but rather attracts too much attention and raises expectations that all radical innovation projects in the portfolio will succeed. Most radical innovation projects will not succeed, even among the best examples of established innovative firms.

As pointed out in the Introduction to this dissertation (Chapter 1), the IF is considered an organizational function, which needs to be integrated into the parent firm to borrow resources for radical innovation projects. This aspect brings us back to the classic work of Lawrence and Lorsch (1967), who show that an organizational function is differentiated from others, but it must be integrated to achieve the firm's goals. This classic theoretical anchorage opens up a relevant avenue of research. According to this classic paper, the primary challenge refers to the interface between different organizational functions, as pointed out by Lawrence and Lorsch (1967). As a consequence, the next topic discusses the theoretical aspect of the integration of organizational functions.

## **2.3. Integration of Organizational Functions**

### **2.3.1. Perspectives from revisiting the classic authors**

In order to address the research question, the first step is to discuss how organizational functions are integrated to achieve the firm's objectives, and we shall begin by examining how four classic authors, Lawrence, Lorsch, Mintzberg, and Galbraith, contribute to the theoretical anchorage of this dissertation.

Revisiting the classic works of Lawrence and Lorsch (1967), Galbraith, Downey, and Kates (2001) and Mintzberg et al. (2006), is an opportunity to analyze the theoretical roots of organizational integration, and it was possible to establish that "how organizational functions are integrated" refers to the following aspects: a) why integrate, and what integration means; b) what is adopted to integrate (integration practices or mechanisms), and who are responsible for integrating (one person or a group or team, called integrators).

#### **2.3.1.1. Why integrate, and what integration "means"**

Galbraith, Downey, and Kates (2001) remember that integration is necessary to: i) align different organizational functions around the firm's priorities and strategies; ii) share learning and knowledge across the firm; iii) allocate resources to the organizational functions; and iv) solve conflicts over the use and allocation of these resources. According to Lawrence and Lorsch (1967) integration is "*the process of achieving unity of effort among the various subsystems in the accomplishment of the organization's task*" (Lawrence & Lorsch, 1967, p.4). The subsystems are organizational functions such as sales, research, and manufacturing/production.

The basic assumption that Lawrence and Lorsch (1967) adopt is that a firm is an open system, in which the behaviors of the members are interrelated, interdependent with the formal organization, the tasks to be performed, the personalities of other individuals, and the unwritten rules on the proper conduct of a member. Lawrence and Lorsch (1967) consider a firm, therefore, as a system. They explain that to the extent that a firm grows, the firm differentiates

into parts, and the functioning of these separate parts (research and development, commercial and production departments) has to be integrated to make the whole system viable. These parts – organizational functions – of the system must also be linked to realize the full purpose of the firm. The organizational function integration is a consequence of the differentiation of the distinct parts of the system. For Lawrence and Lorsch (1967) differentiation is “*the state of segmentation of the organizational system into subsystems, each of which tends to develop particular attributes in relation to the requirements posed by its relevant external environment*” (Lawrence & Lorsch, 1967, p.3).

Lawrence and Lorsch (1967) explain that each organizational function (e.g., research and development, manufacturing/production) differ according to four attributes: i) formal structures: structure refers to aspects of behavior in organizations subject to pre-existing programs and controls (e.g., a more complex organizational function, working on uncertain activities, tends to perform better with a less formal structure), ii) the member's goal orientation: for example, marketing managers could be expected to be more concerned with customer and competitor actions, while production executives would be more oriented toward the operation of equipment and the supplier's outputs, and iii) member's time orientations (related to the timespan of definitive feedback). For example, the members of a production function have a short-term orientation because they receive feedback on its efforts on an almost daily basis. On the other hand, the members of a research and development function have a more long-term orientation because their feedbacks might occur only on the completion of a project lasting well over a year; and iv) member's interpersonal orientation: a cognitive and affective orientation toward the objects of work, which is manifested in a person's interpersonal style (e.g., members of one organizational function in their interpersonal relations will be primarily concerned with either task accomplishment or social relationships).

Lawrence and Lorsch (1967) state that when it becomes necessary for joint decision-making, those in charge of each organizational function have different interests and viewpoints. For example, it is natural for the manufacturing department and the commercial department to hold different opinions about the best price for a particular product. The sales director might prefer a lower price, which would allow them to compete with competitors more easily. On the other hand, the head of the manufacturing department responsible might prefer a higher price, which would allow greater range comparing with the production costs.

Not only can the definition of the price of a particular product generate a situation of conflict. Other conflicts also arise from the difficulty to reach a common denominator about the characteristics that a new product might possess. One typical example is the conflict between commercial and production departments, as pointed out by Lawrence and Lorsch (1967). For instance, when the head of a commercial department aims to offer improved or innovative products to meet new customer demands, the head of the production department, even with the assistance of the research and development department, maybe not always be able to achieve such expectations. Thus a conflict could emerge. Production and R&D departments would try to show the commercial department that the new features of the products would be hard to come by.

### **2.3.1.2. What is adopted to integrate (integration practices), and who the integrators are**

The denomination of integration practices adopted here is an attempt to include the different denominations of the same object adopted from the different classic authors. Lawrence and Lorsch (1967) used the term “integration devices”, Mintzberg et al. (2006) in their book in Portuguese “mecanismos de conexão” [connection mechanisms], Galbraith, Downey and Kates (2001) “coordinating mechanisms”.

In this dissertation, integration practices mean the establishment of a mechanism to coordinate the activities within the established firm, to achieve the aims of the IF. Here integration practices and integration mechanisms are considered to be interchangeable terms.

For Lawrence and Lorsch (1967) the integration mechanisms might be: i) an integrated team with a specific mission to align the requirements of different organizational functions to achieve the firm's objectives (integrator); and ii) the formal hierarchy of decision-making, what Lawrence and Lorsch (1967) call a classic corporate hierarchy model, where the highest formal hierarchy should take decisions. Lawrence and Lorsch (1967) built the original contingency idea that firms adapt integration practices to their environments to ensure the effective coordination of activities in internal differentiated organization functions, and the lack of integration practices may be manifested in the absence of cooperation, communication problems, and sub-goal pursuit.

Lawrence and Lorsch (1967) also believe that integrators (the employee or a team responsible for functional integration) need to be seen by others in the firm as people who have



authority and knowledge about the decisions to be made. According to Lawrence and Lorsch (1967) an integrator is an employee or a team responsible for functional integration to orchestrate work across units. They state that the integrator ensures that the work of each component (e.g., an organizational function) fits in with the overall firm's objectives and that resources within the firm are leveraged and coordinated appropriately. The integrator, as characterized by them orchestrates work across units as the internal boundary-spanning, as defined by Tushman (1977), a term to describe individuals within an innovation system who have, or adopt, the role of linking the firm's internal people.

According to Galbraith, Downey, and Kates (2001), the integration practices can be the implementation of networks of interpersonal relationships, lateral processes, integrative (integrator) roles, and matrix structures. Mintzberg et al. (2006) exemplify the integration practices as: (i) the implementation of task force teams and support committees to bring together members from distinct organizational areas to accomplish a specific demand; or (ii) the integration managers, who are responsible for ensuring that the required integration is achieved.

This dissertation does not intend to make a list of all possible integration practices or mechanisms. Firms can adopt them concurrently according to their specific interests and objectives, following the well-known phrase used by contingency theory researchers: "*there is no one best way to organize*" (Donaldson, 2006). The tables 3 and 4 show an overview of the different practices discussed by the classics, their contributions to the organizational integration, and their limitations.

**Table 3 - Characterization of the integration practices – Part I**

| <b>Integration Practices</b>                               | <b>Definition</b>   | <b>Contributions to the organizational integration</b>  | <b>Sources</b>  |
|--|---|---|---|
| <b>Network</b>   | "interpersonal relationships and communities of proactive that underlie all other types of lateral capability <sup>8</sup> and serve to coordinate work informally" (Galbraith, Downey, & Kates, 2001, p. 136).       | "Encourages spontaneous knowledge sharing across functions, business, and geographies, as well as serves as a fertile ground for innovation. Provide opportunities for different groups to learn or work together" (Galbraith, Downey, & Kates, 2001, p.142).                   | Galbraith, Downey and Kates (2001)  |
| <b>Lateral process</b>                                     | "Lateral processes are major activity and decision flow that cut across functions and deliver the end products and services that create customer value" (Galbraith, Downey, & Kates, 2001, p.151).                    | "Provide information and shape decisions in order to coordinate activities spread out across different units of the organization" (Galbraith, Downey, & Kates, 2001, p.151).  | Galbraith, Downey and Kates (2001)  |
| <b>Integrative (integrator) role / integration manager</b> | "managerial, coordinator, or boundary-spanning positions charged with orchestrating work across units" (Galbraith, Downey, & Kates, 2001 p.137).  | "Leaders and managers should play an integrative role, ensuring that the work of each component fits with the overall business objectives and resources within the organization are optimally leveraged and coordinated among units" (Galbraith, Downey, & Kates, 2001, p.165). | Galbraith, Downey and Kates (2001)<br>Mintzberg et al. (2006)<br>Lawrence and Lorsch (1967) |
| <b>Matrix structure</b>                                    | Organizational structure, based on creating of "dual reporting relationship in order to manage the conflicting needs of functional, customer, product or geographic forces (Galbraith, Downey, & Kates, 2001, p.137). | Offers a simultaneous focus on multiple perspectives and more effective use of technical and specialized resources (Galbraith, Downey, & Kates, 2001, p.171).   | Galbraith, Downey and Kates (2001)<br>Mintzberg et al. (2006)                               |

<sup>8</sup> As following appointed, according to Galbraith, Downey and Kates (2001) lateral capability is the firm's "ability to build, manage, and reconfigure the various coordinating mechanism to achieve its strategic goals" (p.136)

|                         |   |  |   |
|-------------------------|---|--|---|
| <b>Integrative Team</b> | Teams are "a cross business structure that bring people together to work interdependently and share collective responsibility for outcomes" (Galbraith, Downey, & Kates, 2001, p.136)<br>Comprises, for example, cross-business teams, task force teams and committee teams | <p><u>Task force</u>: solve a short-term problem</p> <p><u>Cross-business teams</u>: put "together people with different organizational skills and perspectives (...) reduce the need for hierarchy in decision making (...) they are an essential component of an integrated, flattened organizations"( Galbraith, Downey, &amp; Kates, 2001, p.156).</p> <p><u>Committee team</u>: are institutionalized teams, that bring together members of different units or organizational functions, on a permanent and regular frequency to discuss issues of common interest (Mintzberg et al. 2006 p.190).</p> | Galbraith, Downey and Kates (2001)<br>Mintzberg et al. (2006)<br>Lawrence and Lorsch (1967) |
| <b>Formal hierarchy</b> | Corporate hierarchy position, where decisions should be taken according to the formal hierarchy   | In low innovative firms, the required integration might be at the higher levels of the hierarchy. In high innovative firms, it is the opposite (Lawrence & Lorsch, 1967).  | Lawrence and Lorsch (1967)  |

Source: The author

**Table 4 - Characterization of the integration practices– Part II**

| <b>Integration Practices</b>   | <b>Limitations</b>  | <b>Sources</b>  |
|--|---|---|
| <b>Networks</b>  | <ul style="list-style-type: none"> <li>- Might be too informal to rely on for critical decisions</li> <li>- Dependent on spontaneous interactions</li> <li>- Few documented processes</li> <li>- Difficult to capture learning across the firm</li> </ul>   | Galbraith, Downey and Kates (2001)  |
| <b>Lateral processes</b>   | <ul style="list-style-type: none"> <li>- Require dedicated time from staff to develop and implement processes</li> <li>- May increase bureaucratic tendencies, documentation and compliance with the process create rigidity</li> </ul>   | Galbraith, Downey and Kates (2001)  |
| <b>Integrative (integrator) roles / integration managers</b>   | <ul style="list-style-type: none"> <li>- Cost associated with hiring individuals</li> </ul>   | Galbraith, Downey and Kates (2001)<br>Mintzberg et al. (2006)<br>Lawrence and Lorsch (1967) |
| <b>Matrix structure</b>  | <ul style="list-style-type: none"> <li>- Dual reporting relationships can cause conflict</li> <li>- Increased need for complex communication due to ambiguity</li> <li>- Employees may feel lost without a permanent home</li> </ul>  | Galbraith, Downey and Kates (2001)<br>Mintzberg et al. (2006)                               |
| <b>Integrative team (Comprises e.g., cross-business teams, task force teams and committee teams)</b> | <ul style="list-style-type: none"> <li>- May increase conflict in the organization and the time required to resolve it</li> <li>- Require investment of internally focused time to build team skills and develop operating agreements</li> <li>- Some teams, as task force, are temporary; do not appropriate to develop capabilities continuously.</li> <li>- Rely on healthy informal systems and networks</li> </ul> | Galbraith, Downey and Kates (2001)<br>Mintzberg et al. (2006)                               |
| <b>Formal hierarchy</b>  | <ul style="list-style-type: none"> <li>- Hamper the ability to respond to established firms to deal with innovative projects.</li> <li>- Does no work in a complex and highly competitive environment</li> </ul>  | Volberda (1999)<br>Graetz and Smith (2009)  |

Source: The author based on Galbraith, Downey and Kates (2001)

### 2.3.2. Critical analysis of the classics

Despite the prescriptive contribution from the classics shown in the last topic, there is a group of criticisms related to the classic author's contributions. These criticisms emerge when the classic authors are compared with the current literature on the development of radical innovation projects in established firms. The criticisms refer to the main contributions of Lawrence and Lorsch (1967).

One of the points advocated by Lawrence and Lorsch (1967) is the definition "*a priori*" of the sequence of activities to be accomplished and the organizational functions (engineering, commercial, manufacturing departments) to be integrated. In the empirical studies of Lawrence and Lorsch (1967), innovation project development is based on linear models for project development. It is similar to the first approaches focused on the new product development process, as pointed out by Utterback and Abernathy (1975), and Cooper (1993). The main characteristics are the strong process-based bias, highlighting the different activities and decisions involved in a project through various stages. The process is linear, emphasizing the set of proposed steps, each one consisting of a list of preset, cross-functional, and parallel activities.

The examples pointed out by Leifer, O'Connor and Rice (2001), Raisch (2008), O'Connor et al. (2008), Tushman et al. (2010), Gassmann, Widenmayer and Zeschky (2012) and Birkinshaw, Zimmermann and Raisch (2016) show that the development of radical innovation projects are not driven by linear process and demonstrate that the development of such innovations is not based on linear models of innovation management, but rather on those that can express the integration between groups within the firm and external partners from outside.

As pointed out by O'Connor et al. (2008), the development of radical innovation projects needs to be considered a complex phenomenon, uncertain, oriented by learning and experimentation and not by stage-gate approaches such as go-kill criteria. Besides, as Benner and Tushman (2015) state, firms are now able to engage communities of developers, professionals, and users for innovative core activities through platform-based ecosystems. Although innovation in the past also considered the established firm as the focus, alternative perspectives, such as "open" innovation, ecosystems, co-developing, have pushed innovation increasingly outside firms' boundaries.

Furthermore, the firms analyzed by Lawrence and Lorsch (1967) developed their innovations based on the following assumptions: (i) customer needs could be clearly specified at any time; (ii) causal relationships were understood with reasonable accuracy; for instance, the market share or the total sales could be previously estimated; and (iii) the firms were able to collect and analyze the customer's requirements or needs. As described by Leifer, O'Connor, and Rice (2001), O'Connor et al. (2008), O'Connor and Rice (2013), Slater, Mohr and Sengupta (2014), radical innovations are often characterized by considerable market uncertainties. Such clarity and speed in the feedback of market information, as described by Lawrence and Lorsch (1973), is often not possible.

As a consequence, there was a doubt whether the findings of the classic authors, despite their outstanding contributions, are discussed by the current literature. As explored in one of the propositions of this dissertation (topic 2.5.), despite these criticisms, this dissertation assumes that the classics can offer significant contributions to answer the research question. Despite the apparent temporal distance between the contributions of the classics and the present day, Tushman (2017) remember that several decades after their initial findings of Lawrence and Lorsch, who started publishing their findings on organizational integration in the sixties, the concepts of differentiation and integration continue to interest business scholars studying a wide variety of problems such as structural ambidexterity. Consequently, it is no coincidence that current papers, such as those of Raisch et al. (2009), O'Reilly and Tushman (2013), Benner and Tushman (2015), and Birkinshaw, Zimmermann, and Raisch (2016), point to the contributions of Lawrence and Lorsch (1967). In this way, this dissertation aims to examine the current debate referring to the integration of organizational functions.

Some questions guide the second part of the literature review: How does the literature on organizational integration deal with the integration necessary to foster the continuous and systematic development of radical innovation projects? What are its boundary conditions? What are the different literature debates in this context?

### 2.3.3. **Perspectives from the current debate**

The current debate is analyzed following a systematic literature review, carried out using a combination of bibliometric and content analyses. This topic is interested in identifying the current debate. In order to achieve this aim, the literature review focused on the continuous and systematic development of radical innovation projects, based on the organizational integration theoretical perspective.

We have tried to find out what is the current debate regarding the research question, identifying the findings and contributions from the literature to the aims of this dissertation. The bibliometric analysis was used as a method to identify and select the main theoretical references through a quantitative analysis of a sample of papers and citations, as shown in the previous chapter. This method is also useful to identify critical scientific works as well as their interrelationships. Content analysis followed a structured process that was adapted from previous approaches, notably Pashaei and Olhager (2015). Content analysis was an attempt to accomplish an in-depth discussion of the bibliometric outputs, consisting of the network analysis shown below.

Initially, the most crucial information from the selected papers (66 papers, as explained below) was identified, extracted, and stored. A spreadsheet was then built to summarize, organize, and analyze information, including authors, focus, year of publication, research objectives, methodology, research questions, and contributions of all 66 papers (Appendix 1 provides the list of all 66 papers). Table 5 presents an example of the raw material to perform the qualitative analysis of the selected papers.

**Table 5 - Four examples of raw material to analyze the 66 papers**

| <b>Authors</b>                                  | <b>Research questions or problem</b>   | <b>Focus / objective</b>   | <b>Methodology</b>   | <b>Contributions</b>  |
|---|--|--|--|---|
| <b>Chen and Kannan-narasimhan (2015)</b>        | How do organizations, for example, connect the vested interests and formal responsibilities of these structurally separated organizational entities? What is the role of funding or project ownership in determining collaboration?  | Explain the processes through which organizations can reintegrate new ventures into their core businesses.   | Case studies of 09 established firms                                   | Identification of formal administrative and resource mechanisms that enable collaboration between core business unit and new venture units to incubate new businesses.  |
| <b>Gassmann, Widenmayer, and Zeschky (2012)</b> | How do firms achieve the transfer and implementation of radical innovation to operational business?  | Informal mechanisms identified in theory such as socialization strategies, lateral or cross-departmental relations, and informal communications.     | Case studies of 07 large multinational, technology intensive companies | Identification of informal mechanisms, at the new venture unit and the core business unit level, mostly based on willingness of participating entities to work together, through which new ventures integrate innovations into core business units. These mechanisms include gaining external validation, innovation showcasing, liaison channeling, network building, and collaborative decision making. |
| <b>O'Reilly and Tushman (2008)</b>              | How do organizations survive in the face of change?  | Set of senior team processes and actions that enable firms to integrate and recombine resources to permit simultaneous exploitation and exploration. | Theoretical debate   | Discussion about how ambidexterity becomes a dynamic capability. One of the argument is that it occurs only if the firm's exploitation and exploration activities are strategically integrated.   |
| <b>Westerman, Mcfarlan and Iansiti (2006)</b>   | The literature suggests that the field has not yet converged on a common theory of organization design for innovation. Although innovation researchers developed their theories from empirical analysis, few have tied their recommendations directly to key constructs of contingency theory. | How firms address conflicts in strategic contingencies, how managers adjust to misfits, and how organizations adapt their designs.                   | Case studies of 04 established firms                                   | Found out that firms use one of three adaptation modes, none of which is fully autonomous nor fully integrated, and all of which change over time.  |

Source: The author



As result of the growing number of scientific publications, as well as the ability to analyze citations to identify important scientific works and their interrelationships, the literature has increased the importance of bibliometric analysis (Homrich et al, 2018), which followed a structured process to identify and select the main theoretical references, through a quantitative analysis of a sample of papers and their citations.

The content analysis was combined with bibliometric analysis to identify literature trends, topics and fields most frequently discussed, and gaps that may exist in this literature. This analysis analysis generated the following outputs offering contributions to the development of the dissertation. There is a myriad of networks (as shown below) that can be built (Homrich et al., 2018), and this dissertation can hardly aim to build all possible networks but rather focuses on exploring significant findings throughout the built networks. The main contributions refer to: i) identifying the leading journals and papers in the database (66 papers); ii) discovering the communities of researchers: “who is this dissertation talking to?”; iii) highlight how the current literature discusses organizational integration to boost radical innovation projects; iv) pointing out the importance of "integration" and "resource" and complementary literature, v) selecting criticisms of the current literature discussion.

#### **2.3.3.1. Context and data collection process**

The bibliometric analysis follows similar steps used by Carvalho, Fleury, and Lopes (2013), beginning with the search for the terms in the ISI Web of Science, going through the prioritizing process to build the final papers database.

The Thomson Reuters ISI Web of Science database was selected as the bibliometric database because of the possibility to extract the metadata such as abstracts, authors, institutions, number of citations, references (papers cited in the references), and the journal impact factor. The database was prioritized on January 22, 2018, according to the following steps. On July, 2, 2018, the database was updated.

The first step was to select the terms to search for in the abstracts, paper title, keywords of the papers. Besides, this step filters the papers according to the categories of the study field, as follows.

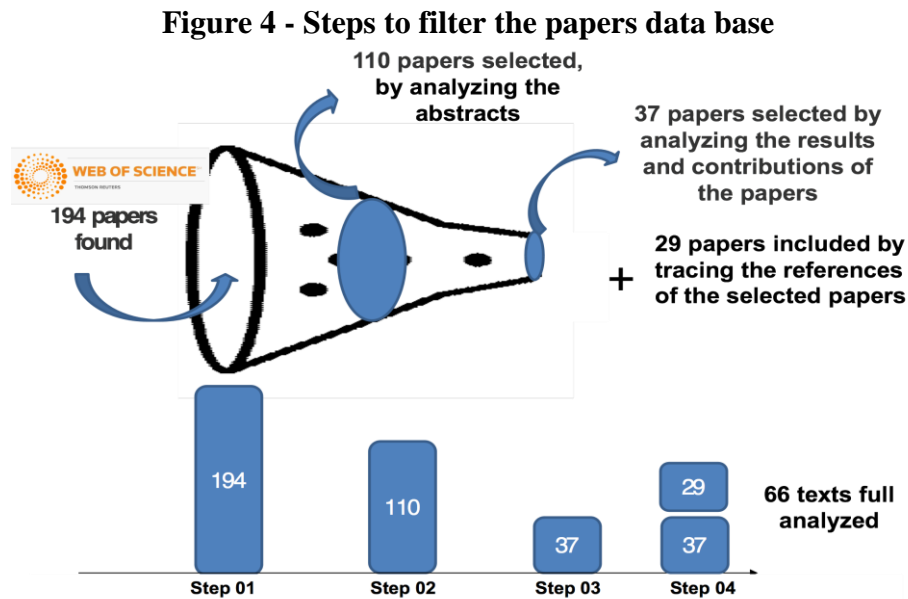
- Topics: ("radical innovation") OR ("discontinuous innovation") OR ("breakthrough innovation") OR ("disruptive innovation") OR ("major innovation") OR ("really new innovation")
- Refined by: Topics: ("exploration" OR "exploratory" OR "ambidexterity" OR "ambidextrous" OR "organizational structure" OR "organizational integration" OR "organizational interface" OR "organizational design" OR "integration mechanism" OR "coordination mechanism")
- Categories of Web of Science: (management or business or engineering industrial or operations research management science or engineering multidisciplinary or planning development or multidisciplinary sciences or economics)

Two details need to be clarified. First, in order to cover a broad spectrum of high innovation definitions, a conservative approach was initially adopted. The “topics” session includes not just the “radical innovation” term but also “major innovation”, “breakthrough innovation”, “disruptive” and “discontinuous innovation”. Naturally, this dissertation does not argue that the different definitions refer to the same phenomenon. As pointed out by Garcia and Calantone (2002), there are many different definitions of innovations, which in most cases are treated without a consistent distinction. As the searching process evolved, during the more analytical steps, the necessary distinctions and filters were made.

The second details refer to the search for ambidexterity literature. This dissertation considers that there is a vast helpful literature (e.g., Tushman & O’Reilly, 1996; Tushman et al., 2010; Raisch, 2009; Gassmann, Widenmayer, & Zeschky, 2012). Since the nineties, this literature has discussed structural ambidexterity, especially involving the separation of the organizational form of the parent firm, focussing on exploring new markets, products, and business opportunities. Consequently, the terms related to ambidexterity (e.g., “exploration”, “exploratory”, "ambidextrous") were included in the search process.

Figure 4 sums up the main steps of the data collection process. The first step found 194 papers in all the database. All abstracts were then read and analyzed (second step). As a result, 110 papers were selected. The third step was the analysis of the results and contributions of the 110 chosen papers. The third step generated 37 selected papers. A fourth step was necessary to include references to other papers. Felekoglu and Moultrie (2014) mention that some important papers which do not use the selected terms adopted

at the first phase might be missing but investigated a similar subject. Then, the fourth step added 29 extra reference papers such as Birkinshaw, Zimmermann and Raisch (2016), Slater, Mohr and Sengupta (2014), O'Connor and Rice (2013), Andriopoulos and Lewis (2010), Raisch et al. (2009), Gupta, Smith and Shalley (2006). These 29 papers have been cited frequently as essential papers in the 37 papers selected at the third step. Appendix 1 lists all the 66 papers.

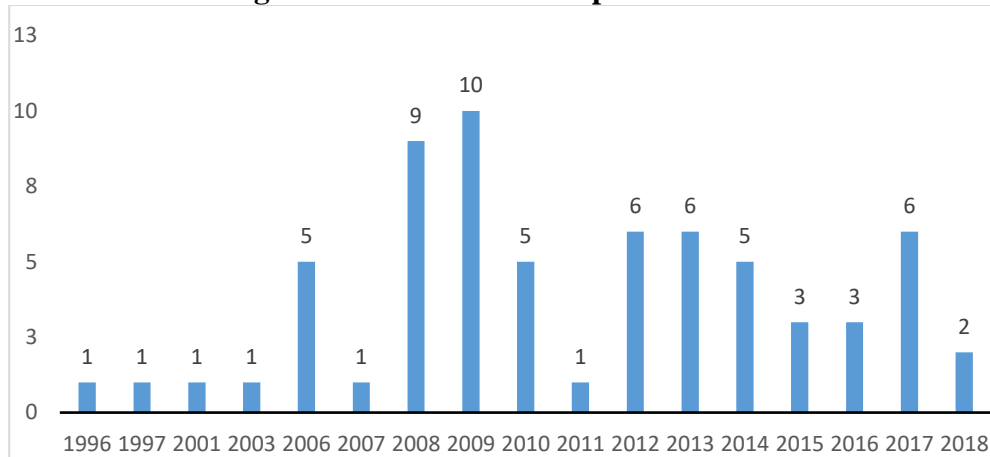


Source: The author

### 2.3.3.2. Main journals and most cited papers

Based on the initial results of the bibliometric analysis, it was possible to observe the progress of the publications in the selected database (66 papers). Considering the number of publications over the years, as shown in Figure 5, an upward trend lasted until 2008 and 2009, when there was a peak in the number of publications. Despite the sharp decline in the number of publications in 2011, during 2012, 2013 and 2017 the discussion continued to attract the attention of the researchers.

**Figure 5 - Overview of the publication evolution**



Source: The author based on ISI Web of Science data base

Other descriptive data demonstrate the journals with most publications: *Journal of Product Innovation Management* (13 out of 66 publications), *Organizational Science* (7 out of 66 publications) and *R&D Management* (5 out of 66 publications).

The first, *Journal of Product Innovation Management (JPIM)*, published 13 papers in the database selected for this dissertation. This journal focuses on advancing theoretical and managerial knowledge on product and service development, involving all sizes of firms (start-ups, small-medium, and large enterprises) and quantitative and qualitative methodologies. The second journal, *Organizational Science*, published 7 papers in the database. It is widely recognized as one of the top journals in the fields of strategy, management, and organization theory and publishes research on firms, including their processes, structures, technologies, identities, capabilities, organizational forms, and performance. The third journal, *R&D Management*, with 5 papers in the database, publishes papers which address the interests of R&D and innovation management researchers and practicing manager communities and covers the following research topics: product development, design and innovation, innovation strategies, human resource issues, and the social, economic and environmental implications of innovation.

The papers from these three journals make important contributions, discussing relevant points such as i) the systematic perspective of the development of radical innovation projects in established firms; ii) unexplored questions on organizational differentiation and integration according to the ambidexterity perspective; iii) aspects that the established firms adopt to share the firm's resources with separate organizational

forms; and iv) the integration mechanism adopted by established firms to integrate separate organizational forms focused on exploratory activities.

Slater, Mohr, and Sengupta (2014), O'Connor (2008) and Kelly (2009) are examples of papers from the JPIM. They state that the development of radical innovation projects does not only rely on the isolated actions of a narrow group of people or even a single one acting as a "champion", supported by sponsors.

Slater, Mohr, and Sengupta (2014) propose a testable model of the antecedents of radical product innovation success, believing that this success depends on the correct performance of different organizational components: the strategic intentions of senior leadership; the corporate culture (e.g., customer orientation, technological orientation, competitor orientation, and learning orientation); the organizational form (e.g., multifunctional project team); and the product launch strategy.

O'Connor (2008) presents a framework to continuously and systematically develop radical innovation in established firms. She anchored the discussion in systems theory, dynamic capabilities theory, and innovation management literature. The framework is made up of seven elements that together form a management system. These system elements are (1) an identifiable organization form; (2) interface mechanisms with the mainstream organization, some of which are tightly coupled and others which are loose; (3) exploratory processes; (4) requisite skills and talent development; (5) governance and decision-making mechanisms in the project, portfolio, and system levels; (6) appropriate performance metrics; and (7) an appropriate culture and leadership context.

Kelly (2009) examines how established firms separate organizational forms to foster radical innovation projects. She points out that the firms must define organizational forms, even initially as a program, which ensure benefits from the firm's resource sharing. In order to achieve this benefit, the integration between the separate organizational forms and the parent firm need to be driven by the following aspects: (1) distinct but evolving objectives that maintain a logical strategic integration; (2) adaptive structures that shift and are transformed but preserve relationships with the broader organization; and (3) flexible processes that are understandable beyond the innovation program and are modifiable, both for the context and in response to learning over time.

Slater, Mohr, and Sengupta (2014), O'Connor (2008) and Kelly (2009) are important papers with important contributions to this dissertation. There are, however, other

essential papers. In order to find these papers, the bibliometric analysis also took into account the number of times a given paper is cited by other scientific papers to determine its level of influence. In other words, the most frequently cited papers have greater importance as drivers of concepts and methods in a given field of research. Based on this assumption, and using the number of citations of each paper, it was possible to build a list of the most cited articles in the 66 papers selected. Table 6 presents the list of the most ten cited papers.

**Table 6 - Ten most cited papers**

| Authors   | Title  | Citation | Year |
|---|--|----------|------|
| <b>Brown, SL; Eisenhardt, KM</b>                                    | The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations              | 1424     | 1997 |
| <b>Tushman, ML; O'Reilly, CA</b>                                    | Ambidextrous organizations: Managing evolutionary and revolutionary change   | 1195     | 1996 |
| <b>Gupta, AK; Smith, KG; Shalley, CE</b>                            | The interplay between exploration and exploitation   | 943      | 2006 |
| <b>Jansen, JJP; Van den Bosch, FAJ; Volberda, HW</b>                | Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators | 763      | 2006 |
| <b>Raisch, S; Birkinshaw, J</b>                                     | Organizational ambidexterity: Antecedents, outcomes, and moderators  | 617      | 2008 |
| <b>Raisch, S; Birkinshaw, J; Probst, G; Tushman, ML</b>             | Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance                                       | 529      | 2009 |
| <b>O'Reilly, CA; Tushman, ML</b>                                    | Ambidexterity as a dynamic capability: Resolving the innovator's dilemma   | 449      | 2008 |
| <b>Andriopoulos, C; Lewis, MW</b>                                   | Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation                                 | 384      | 2009 |
| <b>Siggelkow, N; Levinthal, DA</b>                                  | Temporarily divide to conquer: Centralized, decentralized, and reintegrated organizational approaches to exploration and adaptation  | 298      | 2003 |
| <b>Jansen, JJP; Tempelaar, MP; van den Bosch, FAJ; Volberda, HW</b> | Structural Differentiation and Ambidexterity: The Mediating Role of Integration Mechanisms   | 286      | 2009 |

Source: Author's searching in the ISI Web of Science

The papers by Brown and Eisenhardt (1997), Tushman and O'Reilly (1996) and Gupta, Smith, and Shalley (2006) are the most cited as they build fundamental arguments followed by a large number of researchers.

Brown and Eisenhardt (1997) argue that if an established firm aims to continuously and systematically develop radical innovation they need to create new organizational forms. This necessity emerges when the firm faces a radical change in their markets or needs to promote a radical change in their products. Based on strategy and organization theory, the authors consider that a radical change happens unpredictably and might not be managed beforehand.

Tushman and O'Reilly (1996) argue that established firms should separate exploratory and exploitative activities. They developed the debate around structural ambidexterity and emphasized that the exploratory activities should include a separate organizational form from the ongoing mainstream operation of the parent firm. The separate organizational form might focus on long-term objectives and requires specific tasks, cultures, team member competencies, structure, appropriate business performance evaluation criteria, and an incentive and reward system.

Gupta, Smith, and Shalley (2006) try to identify important research questions which can drive academic researchers, considering different perspectives, stating that the literature on ambidexterity organization is still scarce in many areas and call on the community to try to improve theoretical discussions. They point out some provocative questions, for example: Are exploration and exploitation two ends of a continuum or orthogonal to each other? How should organizations achieve a balance between exploration and exploitation? Must all established firms strive for a balance, or is specialization in exploitation or exploration sometimes sufficient for long-run success?

The findings of these three papers helped to organize the debate in the area. The debate, however, includes other complementary aspects, which will be highlighted by the bibliometric networks. Bibliometric network analysis in the scientific field assumes that the list of bibliographic references (papers cited in the references of one paper) in a scientific paper is an essential part of the paper. This analysis was built by using tools from the ISI Web of Science database and the VOSviewer software, a tool for creating maps based on network data and for visualizing and exploring these maps. The items in the networks can be connected by co-authorship, co-occurrence, citation, bibliographic

coupling, or co-citation links. In this dissertation, the VOSviewer was adopted to create four networks: a citation document, author co-citation, journal co-citation networks, and title and abstract fields.

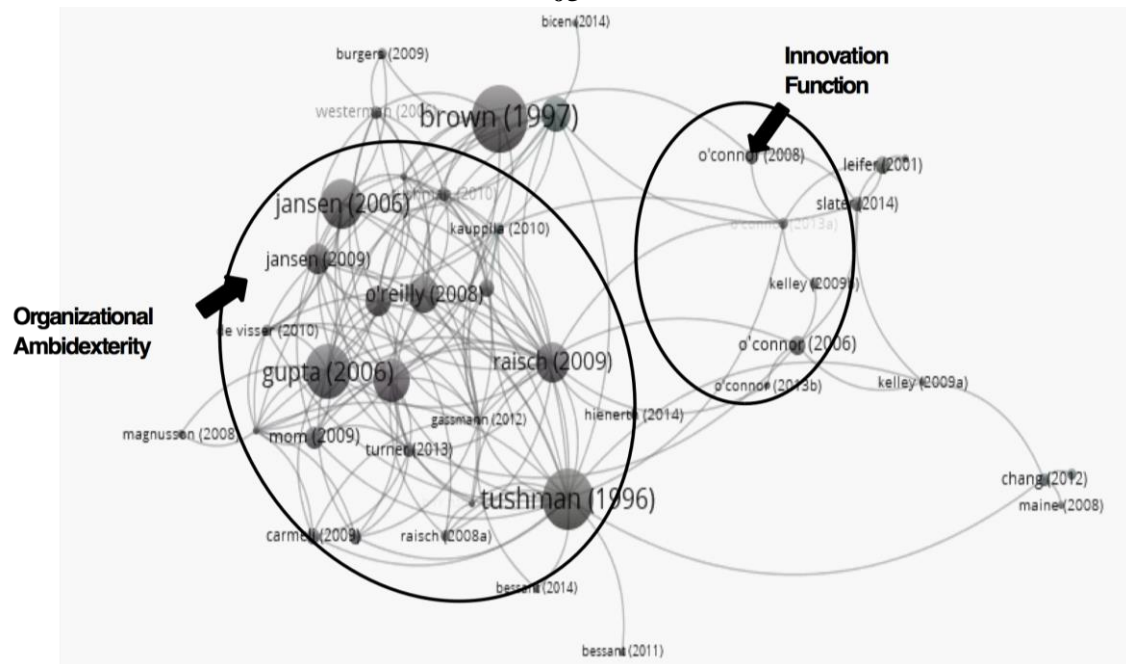
The first network is the citation network, which aims to identify the relatedness between all the papers from the database of 66 papers. To avoid plotting all 66 papers (figure 6 could be “polluted” with so many papers), it was necessary to establish a filter. Considering five as the minimum number of citations of one paper in the ISI Web of Science, the figure 6 plotted on the following network fewer papers and was not “polluted”.

Van Eck and Waltman (2017) inform that the distance between two journals in the citation network indicates the relatedness of the papers. In this network, each circle corresponds to a paper represented by the last name of first author and year of publication. The size of the circles corresponds to the number of times the paper has been cited.

A citation link is a link between two items where one item cites the other. Brown and Eisenhardt (1997), Tushman and O’Reilly (1996), and Gupta, Smith, and Shalley (2006), as appointed earlier, are the most cited papers in the database. In this situation, most of the papers in the database also cite these three papers, then they are represented by the largest circles. Besides, according to the citation document network, most of the papers are concentrated on the left. This side includes papers from the organizational ambidexterity discussion (e.g., Jansen et al. 2009; Raisch, 2009; Gupta, Smith, & Shalley, 2006 and Tushman & O’Reilly, 1996). All of the papers related to the Innovation Function (a smaller portion of the papers) are concentrated on the right of the network map (e.g., O’Connor, 2008; Connor & DeMartino, 2006; Leifer, 2001; Kelley, 2009 and Kelley, Peters, & O’Connor, 2009).



**Figure 6 - Citation network - minimum number of documents of a source: 05**



Source: The author

Few<sup>9</sup> links can be observed in the circle between organizational ambidexterity papers and IF papers. It is an indication to explore the intersections of these two research fields. As noted earlier, structural separation, as defended by the organizational ambidexterity literature, is a necessary condition to allow established firms to continuously and systematically develop radical innovation projects. However, this dissertation argues that this condition is not sufficient in itself.

### 2.3.3.3. Communities of researchers - "who does this dissertation talk to?"

A second important aspect can be found by considering other networks from the bibliometric analysis. For example, there are two networks of the "communities" of the subject of this dissertation. As noted by Fleury (2010), a scientific researcher needs to know what are the main communities of researchers, which surrounded their dissertation subject and findings. In other words, it is important to recognize "who we are we talking to". The author and journal co-citation networks help to identify these communities, which are made up of influential researchers, who published in prestigious journals.

<sup>9</sup> Van Eck and Waltman (2017) explain that there is no specific definition about what "few" links means as it depends on the research field, the number of citations, papers, which vary consistently. However, they indicate that it is visually easy to realize where the links are more concentrated and where they are not.

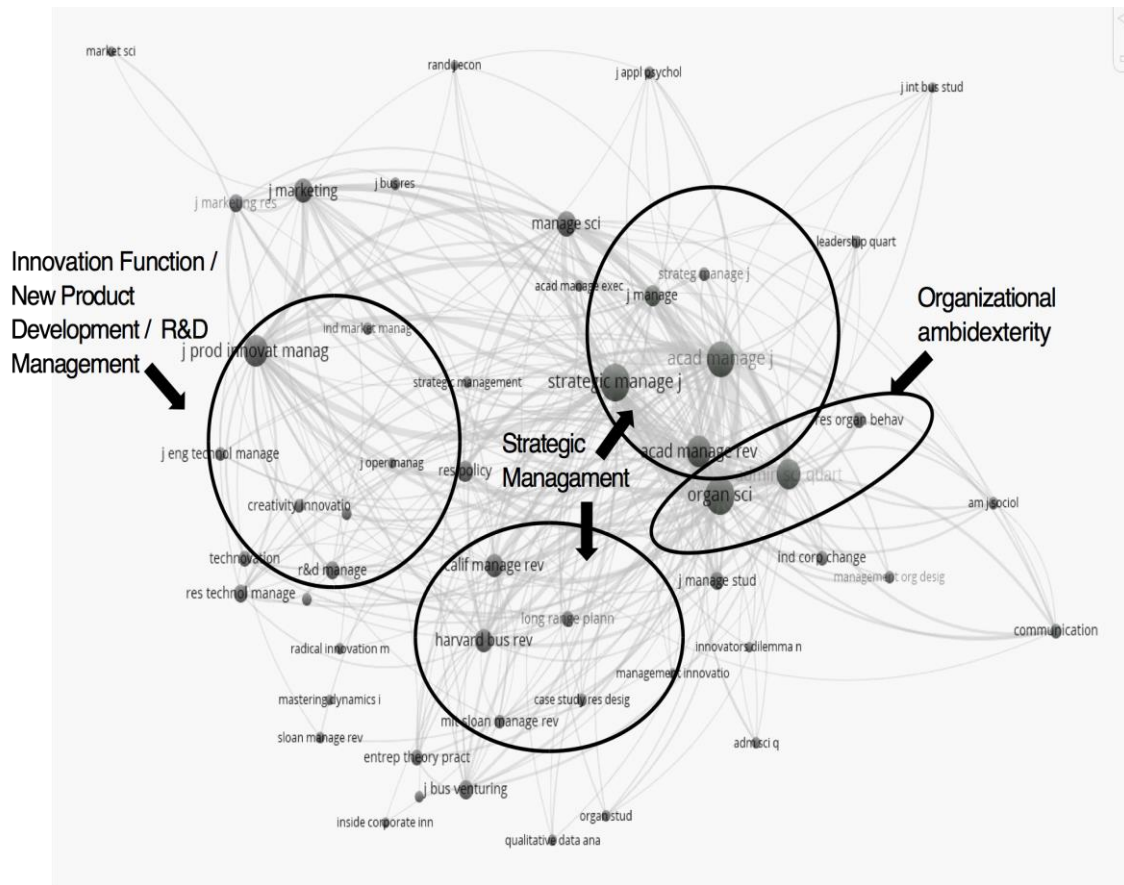
To build the networks to understand “who are we talking to?”, Homrich et al (2018) suggest, for example, adopting the author’s and journal’s co-citation network analysis as these analyses are quantitative techniques applied to capture the impact and importance of an author or a journal. Both networks bring the same logic/reasoning. The obvious difference is that one network deals with the author’s co-citation and the other with the journal’s co-citation. The co-citation network presents the big picture of the research area, meaning that the more the journals (or authors) are cited together, the more likely they are to delineate a “school of thought” (Culnan & O’Reilly, 1990).

According to Van Eck and Waltman (2017), a node in this network symbolizes a journal (or an author). Nodes closer to each other are more similar than nodes farther from each other. A link between two nodes indicates a co-citation relationship. In other words, the distance between two journals (or authors) in the visualization approximately indicates the relatedness of the journals (or authors) in terms of co-citation links. In general, the closer two journals (or authors) are located to each other, the stronger their relatedness. Lines also represent the strongest co-citation links between journals (or authors).

To build these two co-citation networks, the following aspects are considered by VOSviewer software: i) identification of all papers cited (references papers) by the papers in the database (66 papers). That is, VOSviewer software identifies all the papers in the references of the 66 selected papers, after, ii) VOSviewer software establishes a co-citation link, which is a link between two items that are both cited by the same paper. In this case, co-citation refers to the frequency with which two papers are cited together by the 66 selected papers. The more co-citations two papers receive, the higher their co-citation strength. All the 66 selected papers cite hundreds of papers. However, a network with hundreds of papers, unfortunately, is visually unsuitable. To filter, the journal co-citation network and the author co-citation network consider just the papers with more than 10 citations.

Figures 7 and 8 and tables 7 and 8 summarize the findings referring to the journal and author co-citation network analyses.

**Figure 7 - Journals Co-citation network: minimum number of documents of a source: 10**



Source: The author

There are at least three different groups including distinguished journals on the innovation management discussion: i) Innovation Function, New Product and Development or R&D Management; ii) Organizational Ambidexterity; and iii) Strategic Management. The main journals derived from the last network are indicated in the next table. As noted previously, the Journal of Product Innovation Management, R&D Management, and Organization Science have published important sources for this dissertation. However, there are others, such as the California Management Review, the Harvard Business Review and the MIT Sloan Management Review, as noted by the co-citation journal network, which also highlight the importance of certain journals traditionally focused on managerial/practical issues. Table 7 summarizes the data of the main journals.

**Table 7 - Main journals derived from the Journals Co-citation network**

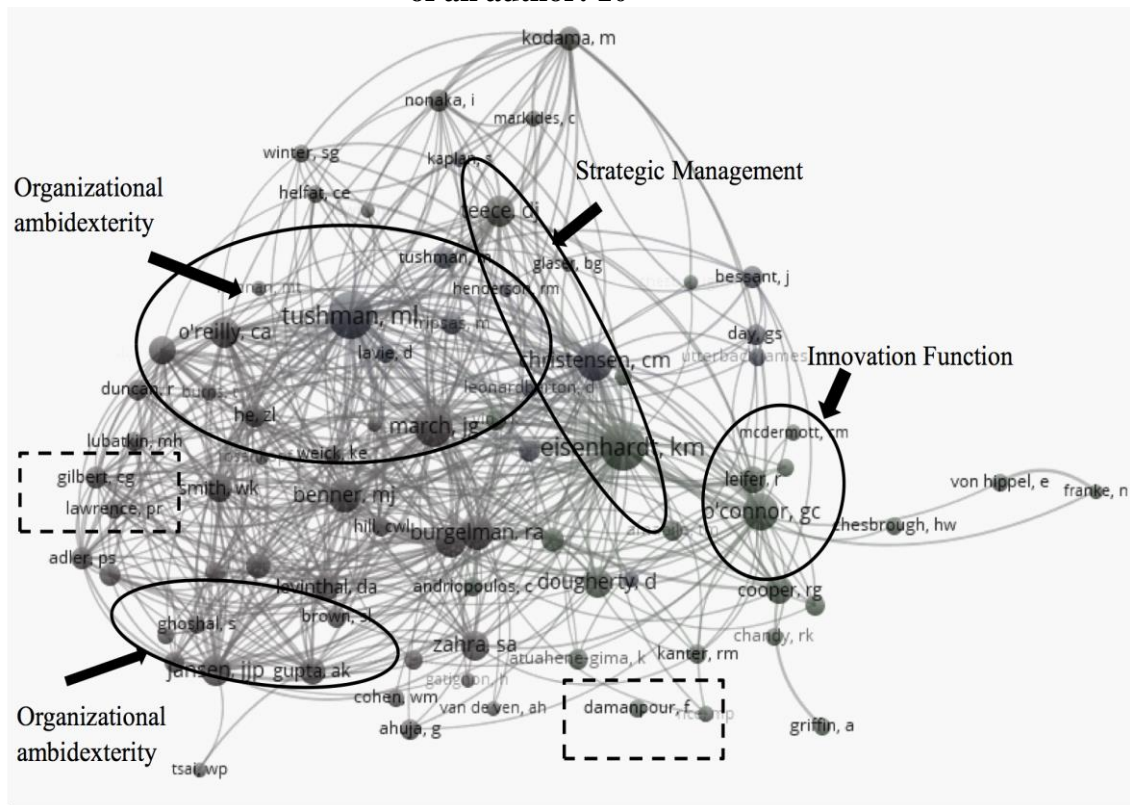
| <b>Main topics</b>   | <b>Main Journals</b>  |
|--|---|
| <b>Innovation Function/<br/>New Product<br/>Development / R&amp;D<br/>Management</b> | Journal of Product Innovation Management (JPIM)<br>R&D Management<br>Research-Technology Management<br>Journal of Engineering and Technology Management<br>Technovation |
| <b>Organizational<br/>Ambidexterity</b>  | Organization Science<br>Research and Organizational Behavior  |
| <b>Strategic<br/>Management</b>  | Academy of Management Journal<br>Strategic Management Journal<br>Administrative Science Quartely  |

Source: The author

For a better understanding of the expression “who are we talking to?”, it is important to identify not just the main journals but also the researchers who are publishing in these main journals. See on the next page figure 8 and table 8. As such, the following network (co-citation author network) is important. According to Van Eck and Waltman (2017), a node depicts an author in this network, and the size of the node indicates the number of publications by the first author in this journal. The nodes closer to each other are more similar than nodes farther from each other. A link between two nodes indicates a co-authorship relationship for one or more publications in this journal.

This network points out a large group concentrated on the main topics of organizational ambidexterity (e.g., O’Reilly, Tushman, Benner, Jansen, Gupta), and on the opposite side there is an Innovation Function group (e.g., O’Connor), and in the middle there is a small group consisting of recognized authors related to the main topics of strategic management (e.g., Teece, Eisenhardt).

**Figure 8 - Co-citation network: authors - minimum number of documents of an author: 10**



Source: The author

**Table 8 - Main authors derived from the authors Co-citation network**

| Main Topics                         | Main authors   | Main Journals   |
|-------------------------------------|--|---|
| <b>Innovation Function</b>          | O'Connor, GC   | Journal of Product Innovation Management (JPIM)   |
| <b>Organizational Ambidexterity</b> | O'Reilly, CA<br>Tushman, M<br>Benner, MJ<br>Jansen, JJP<br>Raisch, S | Organization Science<br>Research and Organizational Behavior                              |
| <b>Strategic Management</b>         | Teece, DJ<br>Christensen, C<br>Eisenhardt, K                         | Academy of Management<br>Strategic Management Journal<br>Administrative Science Quarterly |

Source: The author

This figure also points to other important authors such as the Lawrence, PR (Paul Roger Lawrence, one of the co-authors of the classic paper mentioned several times throughout this dissertation), Damanpour, F (Fariborz Damanpour) and March, J (James March). They are highlighted as dotted rectangles in figure 8. James March and Fariborz Damanpour published seminal papers in the organizational innovation field. March (1991) and Damanpour (1991), for example, have more than 2.000 citations according to ISI Web of Science.

March (1991) discusses the central aspect of organizational learning that has been incorporated by the organizational ambidexterity literature and distinguishes between exploitation and exploration activities, exploitation referring to the set of activities linked to refining or expanding existing products or processes, whereas exploration involves activities dedicated to the creation of fundamentally new products, processes, or market spaces. Skills, processes, and mindsets associated with exploration differ from those associated with exploitation. Damanpour published many papers discussing organizational contingency aspects of the established firms in the innovation management field (e.g., Damanpour, 1991 and Damanpour and Gopalakrishnan, 1998).

#### **2.3.3.4. Integration of organizational functions to boost radical innovation projects**

To carry out the content analysis about the integration of organizational functions to boost radical innovation projects were prioritized the papers and authors from the circles (“organizational ambidexterity”) in the networks portrayed in the last topics (2.3.3.2 and 2.3.3.3).

Considering the structural ambidexterity perspective as previously discussed, Jansen et al. (2009) pointed out that organizational function differentiation can help the ambidextrous firm to maintain multiple inconsistent and conflicting demands. According to O’Reilly and Tushman (2003) and Raisch et al. (2009), this differentiation protects exploitative ongoing mainstream operations from interfering with emerging competencies developed in exploratory functions (such as the IF).

Hill and Birkinshaw (2008) show that isolated organizational form to boost radical innovation hinders interaction with other functional structures that can help to explore new business opportunities, knowledge, markets or products. Besides, as noted by Govindaran and Trimble (2005), O’Connor and DeMartino (2006) and O’Reilly and

Tushman (2013), one of the most challenging task is to continuously and systematically maintain efforts to mobilize intra-organizational relationship to gain legitimacy and acquire the necessary funding for radical innovation projects to take root. Iansiti, McFarlan, and Westerman (2003) admit that by isolating an organizational form an established firm can inadvertently block the resources of its parent organization.

Initial studies on differentiation and integration within ambidextrously established firms (e.g., Tushman & O'Reilly, 1996; Jansen et al., 2009) have pointed to the top management teams (e.g., senior teams) as the necessary integration actor across ongoing mainstream operations and exploratory units, referring to coordination by hierarchy in the functional structure, as noted by classics such as Lawrence and Lorsch (1967) and Mintzberg et al. (2006). As the classic authors claim, the functional structure encourages specialization by establishing career paths for specialists within their own area of expertise and enabling them to be supervised by one of their own (mainly the most senior).

The initial studies on differentiation and integration, considering the ambidexterity perspective, assume that the supervision by the higher hierarchical levels of the established firms are sufficient to assure integration in ambidextrous firms. Jansen et al. (2009) note that senior teams in ambidextrous firms are expected to recognize and translate different, ambiguous, and conflicting expectations across differentiated exploratory and exploitative units into workable strategies. For Birkinshaw, Zimmermann, and Raisch (2016), resolving tensions by senior teams is a crucial element in their firm's ability to create synergy value across exploratory and exploitative activities and to achieve ambidexterity.

All the classic authors used in this dissertation, Lawrence and Lorsch, Mintzberg, and Galbraith, consider that integration is not an attribution for just the highest organizational hierarchical levels. According to the classics, there is considerable evidence that many established firms implement integration mechanisms in addition to the conventional hierarchy. As highlighted by Lawrence and Lorsch (1967), Mintzberg et al. (2006), and Galbraith, Downey, and Kates (2001), firms implement integration practices to integrate different organizational functions. The existence of integration practices is defended by these authors because in established firms the organizational functions such as sales, research and development and manufacturing are highly

differentiated. Recently, the literature has started to suggest that ambidextrous firms should boost the adoption of integration mechanisms (O'Connor & Demartino, 2006; Raisch 2008; Tushman et al. 2012; Benner & Tushman, 2013).

Jansen et al. (2009), Benner and Tushman (2015) and Birkinshaw, Zimmermann, and Raisch (2016) point out that the mere presence of differentiated exploratory and exploitative organizational forms does not ensure the simultaneous pursuit of perennial exploratory and exploitative activities. However, the point highlighted by O'Reilly and Tushman (2008) is how these organizational forms are integrated. In this way, as noted by Lawrence and Lorsch (1967), established firms need to implement integration practices.

Raisch (2008), Jansen et al. (2009), Kelley, Peters and O'Connor (2009), Van Burg et al. (2012), Cantarello, Martini, and Nosella (2012), and Gassmann, Widenmayer, and Zeschky (2012), and Birkinshaw, Zimmermann, and Raisch (2016) contribute to this debate on the implementation of integration practices and are concerned with the integration between organizational forms to foster the development of radical innovation projects and the parent firm to access internal resources for these projects. All these papers analyzed case studies from established firms which created a separate organizational form to explore new business opportunities by developing radical innovation projects.

Birkinshaw, Zimmermann and Raisch (2016) develop a conceptual model for structural integration, based on the dynamic capability perspective, in order to understand how firms adapt to discontinuous change. They defend that the sensing, seizing and reconfiguring capacities to explore new business opportunities are the main contingency aspects to define how to integrate. Gassmann, Widenmayer, and Zeschky (2012) analyze the ongoing mainstream operation integration and new venture units responsible for prospecting, managing and developing a portfolio of radical innovation projects, carrying out seven case studies in large established multinational technology intensive firms. Cantarello, Martini and Nosella (2012) focused on project teams inside the research and development department of one established firm which are responsible for the discovery phase of new technology opportunities, and their activities at the fuzzy front end, which generate ideas, manage them and locate opportunities for new technologies that can boost the current market penetration of the firms. As pointed out earlier, it is a typical situation regarding really new innovation, which also belongs to the subject of this dissertation.



The main findings of these papers were categorized according to the three objectives pointed out in Table 9. It is important to remember that this dissertation does not intend to make a list of all possible integration practices. As this dissertation proposes that there is no best practice, it will not attempt to discover whether there is a maximum number of such practices or to identify which are the best or the most popular. Firms can adopt practices concurrently according to their specific interests and objectives. And here we can again mention the well-known phrase used by the contingency theory researchers: “there is no one best way to organize”.

**Table 9 - Summary of the integration practices**

| Integration practice                                    | Definition  | Advantage   | Source   |
|---|---|---|--|
| <b>Integration responsible “integrator”</b>             | "managerial, coordinator, or boundary-spanning positions charged with orchestrating work across units" (Galbraith, Downey, & Kates, 2001 p.137)   | Higher hierarchical level ensures integration across differentiated organizational forms    | Jansen et al. (2009), Van Burg et al. (2012) and Cantarello, Martini, and Nosella (2012) |
| <b>Network</b>  | "interpersonal relationships and communities of proactive [workers] that underlie all other types of lateral capability <sup>10</sup> and serve to coordinate work informally" (Galbraith, Downey, & Kates, 2001, p. 136) | Facilitate the access to organizational resources   | Birkinshaw, Zimmermann, and Raisch (2016)<br>Kelley, Peters, and O'Connor (2009)         |
| <b>Cross-business unit project teams</b>                | Organizational structure, based on creating of "dual reporting relationship in order to manage the conflicting needs of functional, customer, product or geographic forces (Galbraith, Downey, & Kates, 2001 p.137)       | Establish a project team comprising people from different business units                    | Birkinshaw, Zimmermann, and Raisch (2016)  |
| <b>Cross-unit task forces</b>                           | "a cross business structure that brings people together to work interdependently and share collective responsibility for outcomes" (Galbraith, Downey, & Kates, 2011, p.136)  | Nurture and share different resources   | Raisch (2008)  |
| <b>Lateral process for cross departmental relations</b> | "Lateral processes are major activity and decision flow that cut across functions and deliver the end products and services that create customer value" (Galbraith, Downey, & Kates, 2001, p.151)                         | Support the decision-makers about the market acceptance of the radical innovation projects. | Gassmann, Widenmayer, and Zeschky (2012)   |

Source: The author

<sup>10</sup> As following appointed, according to Galbraith, Downey and Kates (2001) lateral capability is the firm’s “ability to build, manage, and reconfigure the various coordinating mechanism to achieve its strategic goals” (Galbraith, Downey, & Kates, 2001, p.136)

Jansen et al. (2009), Van Burg et al. (2012) and Cantarello, Martini and Nosella (2012) highlight the necessity of the role of the integration managers as they are responsible for the integration responsible between organizational forms such as the IF and the higher hierarchical levels of the established firms. Jansen et al. (2009) cite the integration manager's contingency rewards and their informal social integration with the senior team as alternatives to boost the involvement of the senior teams. Cantarello, Martini, and Nosella (2012) identify the need to establish integration manager interfaces with the firm's highest hierarchical level through periodic meetings between presidents and vice presidents and those in charge of research and development, and the commercial organizational functions. Van Burg et al. (2012) argue for managerial activities to align the firm's strategy board, innovation project 'champions', sponsors, and project development team. They consider the integration of managers necessary to deal with the transition readiness assessment during the development phases of radical innovation projects.

From the perspective of the IF, O'Connor et al. (2008) highlight the existence of the orchestrator, who is an influential person within the firm responsible for orchestrating the management of the DNA (Discovery, Incubation, and Acceleration) model, dealing with the transition of the projects from Discovery to Incubation and then to Acceleration, pacing projects through the pipeline, and designing portfolios. The orchestrator's mission, according to O'Connor et al. (2008), includes, but is not limited to, orchestrating linkages to firm's leadership, to other organizational functions, monitoring mandate creep, orchestrating transitions of mature and radical innovation projects (after Acceleration, for example) into the mainstream organization and funding overview of the projects. As explained by O'Connor et al. (2018) an orchestrator might work behind the scenes to help move the nascent business from discovery to acceleration and then the transfer to operational units.

Birkinshaw, Zimmermann, and Raisch (2016) point out two integration practices to unify the established corporate firm vision of the future and to internally mobilize different human resources to support the development of radical innovation projects: networks and cross-business unit project teams. These two practices are essential to integrate separate organizational structures to explore new business opportunities, as regards really new innovation projects, as defined in this dissertation. For example, Birkinshaw, Zimmermann, and Raisch (2016) discuss the structural separation in a global

market leader in the food business, which aimed to explore new business opportunities in the nutrition and health market.

The support for internally mobilizing different human resources for radical innovation projects can occur at a high hierarchical level. The C-level, as pointed out by Kelley, Peters, and O'Connor (2009), O'Reilly and Tushman (2008), Jansen et al. (2009), might act as coach of the development team or offer specific orientation by different specialists throughout the business units of established firms. Kelley, Peters, and O'Connor (2009) also consider networks as an integration mechanism, viewing networks as the path which enables access through the diverse and situation-specific knowledge needs of an innovation project across the firms' ongoing functions. Besides, for Birkinshaw, Zimmermann, and Raisch (2016), networks might be a necessary condition, but not sufficient in themselves, for the radical innovation development team to access key organizational resources without having to rely on the reporting lines of the internal hierarchical levels.

Raisch (2008) refers to the implementation of cross-unit task forces as an integration practice in terms of resource allocation from established firms to the separated organizational forms for really new innovation projects. He studies how established firms, after encountering an ongoing downward movement in revenue, sought new market opportunities (unknown by the firm) from the structuring of new organizational forms such as the IF, which can be focused on human and infrastructure resource allocation. He defends the cross-unit task force as a formal temporary team to transfer expertise to the separate organizational forms. Raisch (2008) calls this phenomenon nurturing, which permits these units to receive, intellectual support from finance, public relations, purchasing, research and development, and marketing. The cross-unit task forces also share resources. He explains that sharing relates to the synergistic deployment of resources shared between operation infrastructure, such as laboratories and manufacturing facility equipment from ongoing mainstream operations and innovation units. The basic idea is to eliminate the duplication of resource acquisition. Cantarello, Martini, and Nosella (2012) also consider the establishment of cross-unit task forces to exchange knowledge and share resources (technological infrastructure), especially when the development of radical innovation projects is already at a more advanced stage, with at least one testable prototype already in place.

Gassmann, Widenmayer, and Zeschky (2012) identify informal practices at the new venture unit and the core business unit level, mostly based on the willingness of participating entities to work together, through which new ventures integrate radical innovation project development into core business units. These practices include gaining external validation, innovation showcasing, liaison channeling, network building, and collaborative decision making. Their study identifies practices necessary to integrate new ventures such as seeking external validation, innovation showcasing, liaison building, network channeling, and collaborative decision making with core business units. New venture units use legitimation strategies, external validation from prominent customers, and innovation showcasing within their firms to gain acceptance of the radical innovation project and acquire the necessary resources.

These practices described by Gassmann, Widenmayer, and Zeschky (2012), liaison channeling, network building, and collaborative decision making, are based on lateral processes for cross departmental relations, as described by the classics, such as Galbraith, Downey, and Kates (2001). As pointed out by Chen and Kannan-Narasimhan, (2015) in liaison channeling new venture units position innovation champions as boundary spanners in operational businesses. In turn, these champions form linking pins to decision makers within the entire company. It helps managers in the operational mainstream units to bypass the ‘not-invented-here’ syndrome and new venture units to gain adoption for their radical innovation projects. Despite the importance of the champions’ presence, as pointed out by O’Connor (2008), while persistent, skilled, visionary champions are critical for radical innovation development, established firms will never maximize their resources and advantages.

As proposed by Gassmann, Widenmayer, and Zeschky (2012), in network building, senior and middle-level managers in the operational and mainstream business units directly communicate, exchange information, and form personal linkages. Both liaison channeling and network building enable the creation of social ties, which in turn become conducive for radical innovation to spread through the firm. It is similar to the argument of Birkinshaw, Zimmermann, and Raisch (2016) and Kelley, Peters and O’Connor (2009), for whom the network might be a necessary condition, but not sufficient in itself, for the radical innovation development project team to access key organizational resources. Finally, collaborative decision making, as highlighted by Gassmann, Widenmayer, and Zeschky (2012), requires the use of integrative innovation planning.

When using integrative innovation planning, new venture units involve business units in radical innovation research at the early stages of ventures. This enables new venture units to impart a sense of ownership to the business units for these new projects. This early involvement allows business units to accept radical innovation projects with less resistance than if they had become involved at later stages.

Chen and Kannan-Narasimhan, (2015), on the other hand, try to extend the Gassmann, Widenmayer, and Zeschky (2012) findings and to understand how new venture units and core business units collaborate on radical innovation project development. Chen and Kannan-Narasimhan, (2015) focus on formal integration mechanisms through which new venture units and core business units of leading global firms collaborate to develop new businesses opportunities. These opportunities also refer to the really new innovation definition adopted in this dissertation. The new venture units can include multiple aims such as generating ideas, identifying and incubating new business opportunities into a viable emerging business, exploring and developing new technologies, and transforming these technologies into new businesses for the entire firm through three types of opportunities: (a) disruptive; (b) greenfield opportunities that are not core to existing business units; and (c) the opportunities that require cross leveraging between multiple business units.

Chen and Kannan-Narasimhan, (2015) find that another important aspect is the integration of new venture units and core business units (BUs). They discover different allocations of resources for radical innovation projects in different periods for which funding is provided. They find four characteristics related to allocation of resources for projects. First, new venture units help BUs to co-incubate new projects initiated by the BUs, especially in the early phases of the project development. This help for new venture units could include knowledge, people, and finance. Second, BUs are involved in new projects initiated by new venture units from very early on. Such early involvement could include BUs taking over the venture projects when the projects are still very young, or BUs co-funding and co-incubating a venture project from its inception. Third, new venture units first initiate and incubate venture projects then gradually involve BUs to co-fund and co-incubate the projects. Later, BUs fully take over the projects. Fourth, transitional organizational units are created to host new ventures that are too 'mature' for new venture units but are still too young or vulnerable to be directly folded back into established BU's.

### 2.3.3.5. The importance of "integration" and "resources"

Another important aspect of the content analysis refers to the focuses of the main debate within the current literature. The themes and topics discussed in publications can be inferred from titles and abstracts. Thus, the following analysis, using Vosviewer, is based on terms of titles and abstracts in the papers of the references of the database (66 selected papers). VOSviewer software creates title and abstract network considering the most prevalent terms in titles and abstract. The link in figure 9 between two terms means that these terms are together at least in four titles or abstracts<sup>11</sup>. VOSviewer software identified dozens of terms (figure 9 on the next page) that occur in four or more publication titles or abstracts.

Van Eck and Waltman (2017) point out that a node depicts a term in a paper title or abstract. The size of a node indicates the number of publications in which it is present. Nodes closer to each other are more similar than nodes farther apart. Thus, closer nodes are discussed together with similar subjects.

This network brings at least two significant findings to this dissertation: First: the word “integration” is one of the most cited in the title and abstracts. This indicates that this subject is important in the papers database of this dissertation. According to the following figures the ten largest nodes are: capability (19 occurrences), case study (16 occurrences), finding (15 occurrences), mechanism (15 occurrences), challenge (15 occurrences), relationship (12 occurrences), implication (12 occurrences), project (12 occurrences), integration (12 occurrences) and performance (11 occurrences).

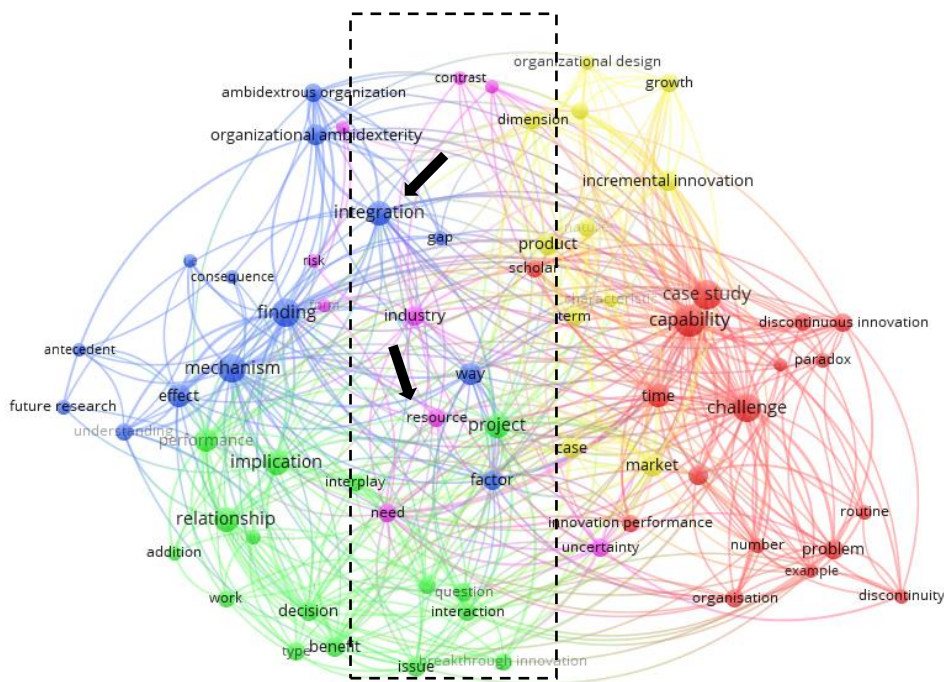
Second, considering the premise that “nodes closer to each other are more similar than nodes farther apart”, the nodes “integration” and “resource” are in the middle of the network (see the dotted rectangle in Figure 9). As noted earlier, this dissertation considers integration according to Lawrence and Lorsch (1967). Integration is “*the process of achieving unity of effort among the various subsystems in the accomplishment of the organization's task*” (Lawrence & Lorsch, 1967, p.4). Resources, as denominated by Barney (1991) means all assets, capabilities, organizational processes, the firm’s

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<sup>11</sup> To build the title and abstract network were adopted the same logic to build co-citation networks. All the 66 selected papers have hundreds of references, which have many terms in titles and abstracts. A network with hundreds of terms is not suitable. To filter, the network in figure 9 considers only the terms that are together at least in four titles or abstracts.

attributes, information, and knowledge controlled by a firm that enables it to conceive of and implement strategies that improve its performance<sup>12</sup>. It is an indication that these two terms are equidistant from most other terms in Figure 9. In other words, “integration” and “resources” are (about) at the same distance from the most terms in Figure 9, not close but neither not far from them. It can be an indication that integration and resources are discussed by subjects which are on the left and right end of Figure 9, such as “capability”, “ambidextrous organizations”, “mechanisms”.

Figure 9 - Titles and abstracts network: Binary Counting. Minimum number of occurrences: 4. Number of terms 67



Source: The author

In order to build an in-depth visualization of the terms “resource” and “integration”, which are two fundamental concepts of this dissertation, two additional networks were generated, also the title and abstract field networks, but focused on just one term. Considering the same network in figure 9, VOSviewer software permits to identify a

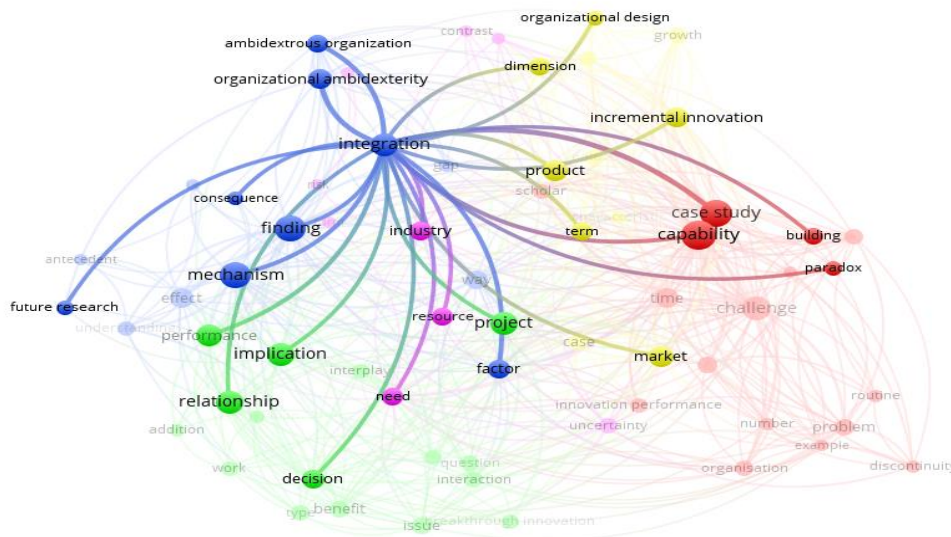
<sup>12</sup> Resources can be the physical capital resources (e.g., firm's plants, laboratories, equipment), human capital resources (e.g., experience, knowhow, relationships, insight of individual workers in a firm, and organizational capital resources (e.g., the firm's formal reporting structure, formal and informal planning, controlling, coordinating systems, informal relations between groups within a firm and between a firm and those in its environment



network specific for one term. The first network focuses on the term “integration”, and the second on “resource”.

These networks gather the terms most related to “resource” and “integration”. As noted by the first, “integration” is a term related to other terms, as noted before, such as “organizational ambidexterity” and “ambidextrous organization”. One of the most closely related terms is the “mechanism”, which offers insight for this dissertation. As discussed in the next topic, many papers discuss different integration mechanisms to integrate separate organizational forms to explore new opportunities, markets, and products based on radical innovation projects with the current business unit and/or ongoing mainstream organizational functions in established firms.

**Figure 10 - Titles and abstract network - focus on “Integration” term**



Source: The author

The “resource” term, although it does not belong to the largest nodes (seven occurrences of “resource”), is also a central term in the title and abstract field network. Based on figure 11, it can be noted which terms are related to “resources”, especially “mechanism”, “capability” and “integration”.



Bower, and adopting the snowball technique<sup>13</sup>, important papers such as those of Christensen and Bower (1996), and Lettice and Thomond (2008) were found. These papers will be discussed below.

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<sup>13</sup> It is an informal technique for a scientific search, consisting of a “hunting process” for additional literature, by identifying complementary papers cited by important papers.

#### **2.3.4. Critical analysis of the current debate**

As similar to the topic 2.3.3.4 (from pages 62 to 70), to carry out the critical analysis of the current debate were prioritized the papers, and authors from the circles (belongs to “organizational ambidexterity”) in the networks portrayed in the last topics (2.3.3.2, 2.3.3.3, and 2.3.3.5).

Two groups of criticisms are related to the current literature debate. The first group refers to three aspects: i) the non-perennial organizational forms, seen as an alternative to the development of radical innovation projects; and ii) the development of radical innovation projects relying on isolated actions of a narrow group of people, or even a single one acting as a “champion”, supported by sponsors (e.g., a high hierarchical member); and iii) discussing about how to integrate different organizational forms, considering the development of a radical innovation project when it is already at an advanced stage (e.g., when at least one prototype is ready). However, not all project development adhere to these contexts.

Despite the advance of the literature, as already pointed out, certain limitations need to be highlighted. In most situations, the literature does not consider the existence of a specific organization focused on perennially exploring new opportunities, knowledge, products, market, based on radical innovation projects. Basically, the literature focuses on temporary organizational forms, considering the development of just one or a few radical innovation projects, such as a multifunctional project team, managed by an internal “champion”, supported by sponsors.

The second group of criticisms is related to the aim of this dissertation to go beyond the fundamental theory anchored in the resource-based view. O’Connor (2008) states that just a stock of resources is not relevant to maintain leadership or a competitive advantage during rapid or unpredictable changes to develop radical innovation projects. In this way, instead of accumulating resources, IF need to be capable to configure the resources in advantageous ways.

This dissertation wants to go beyond the views of Gilbert (2002), and Christensen and Bower (1996), who state that when established firms focus predominantly on the requirements of current customers in their current markets, resource allocation mechanisms will refuse resources to explore new business opportunities based on radical

innovation projects. On the other hand, when the resource allocation focus is guided by a perception of threat to the core business, firms will commit resources to explore new business opportunities. This dissertation aims to extend these arguments.

## **Group 1**

### **Non-perennial organizational forms**

First, the literature (e.g., Gassmann, Widenmayer, & Zeschky, 2012) analyzes the existence of a temporary project team, cross-business unit project teams or multifunctional project teams, as the solution to implement an organizational form to develop radical innovation projects. As pointed out by, O'Connor et al. (2008), Salerno and Gomes, (2018), and O'Connor, Corbett, and Peters, (2018), cross-business unit project teams or multifunctional project teams are not suitable to develop systematically and perennially radical innovation project portfolios as they are limited to accumulating knowledge and capabilities, building portfolios of radical innovation projects, managing them, and increasing the firm's expertise as experience accumulates.

Birkinshaw, Zimmermann, and Raisch (2016), Raisch (2008) Cantarello, Martini, and Nosella (2012) consider the occurrence of temporary organizational forms to develop radical innovation projects and argue that the established firm might need a sequential separation or alternation between exploration and exploitation over time. Birkinshaw, Zimmermann, and Raisch (2016) and Raisch (2008) state that firms might implement perennial organizational forms and place exploration and exploitation activities into different organizational units.

As identified in the following table, the literature points to a myriad of non-exclusive organizational forms that could be adopted by established firms such as a process based organization, innovation programs, innovation hubs, and multifunctional project team. However, each one has limitations for the development of radical innovation projects at established firms.

The organizational forms can vary significantly and are appropriate for specific situations: i) *process based* (e.g., Salerno, 2009), when there is high volume of projects under development together with a similar sequence of activities, which is rare in developing radical innovation projects; ii) *innovation program* (e.g., Baker & Sinkula,

2007; Burgelman & Välikangas, 2005), useful when the focus of the established firms is to stimulate the generation of ideas of new innovation projects; iii) *innovation hubs* (see, Leifer, O'Connor, & Rice, 2001), when the main aim is to integrate into the firm isolated and therefore little known internal entrepreneurs, project sponsors, and hunters and gatherers of business opportunities; iv) *multifunctional project teams* (see, Clark & Wheelwright, 1993) when the established firm aims to isolate a special team to develop one or just a few projects, demobilizing the team as soon as the projects end.

The table 10 summarizes the definition of the different organizational forms.

**Table 10 - Different organizational forms**

| <b>Organizational form</b>   | <b>Definition</b>   |
|------------------------------|---|
| Process-based                | Predefined sequence of activities aiming at a specific goal. It occurs repeatedly internal to an organizational function or crossing horizontally different functions (Salerno, 2009).  |
| Multifunctional project team | Multifunctional new product development teams, comprising competencies and responsibilities that are generally distributed in several organizational functions of the firm (Clark & Wheelwright, 1993).   |
| Internal Innovation Programs | Innovation programs have a wide range of actuation. Normally, it is a temporary multidisciplinary internal team to generate new ideas to explore new markets (Baker & Sinkula, 2007), to stimulate internal corporate venture initiatives (Burgelman & Välikangas, 2005) or open innovation activities to flourish innovation ideas from outside and inside firms (Chesbrough et al. 2006). |
| Innovation Hub               | There is no a clear definition, but can be understood as a focal point to integrate those “who play pivotal roles in making radical innovation happen: the idea hunters and gatherers, internal venture capitalists, member of evaluation and oversight boards, and corporate entrepreneurs experienced in the realm of high uncertainty" (Leifer, O'Connor, & Rice, 2001, p. 114).         |

Source: The author

All these organizational forms are not suitable to systematically and continuously development of radical innovation projects as they are limited to accumulating knowledge and capabilities, building portfolios of radical innovation projects, managing them, and increasing the firm's expertise as experience accumulates (O'Connor et al., 2008; Salerno & Gomes, 2018; O'Connor, Corbett & Peters, 2018).

O'Connor et al. (2008), on the other hand, defend the IF as a perennial organizational function, stating that sequential separation is limited to accumulating knowledge and capabilities, building portfolios of radical innovation projects, managing them, and increasing the firm's expertise as experience accumulates. The alternative is the IF as a permanent structure to concentrate a primary group of activities: having its own core body of knowledge, hierarchy, leadership, a place on the organizational chart, goals, and deliveries. The IF requires the capabilities to evaluate, select, and prioritize radical innovation projects, continuously updating and revising the projects, accelerating the most prominent projects, allocating resources to them, and freezing or deprioritizing the least prominent ones.

**Relying on isolated actions of a narrow group of people, or even a single person acting as a “champion”, supported by sponsors**

Jansen et al. (2009), Van Burg et al. (2012), Cantarello, Martini and Nosella (2012), Griffin et al. (2014), Birkinshaw, Zimmermann and Raisch (2016) highlight the development of radical innovation projects relying on the isolated actions of a narrow group of people, or even a single person on acting as a “champion”. O'Connor et al. (2008), O'Reilly and Tushman (2013), Govindarajan and Trimble (2005), Raisch (2008) emphasize the importance of broadening a debate on the establishment of a systematic perspective, linked to the routine activities of the established firms, in order to continuously boost the radical innovation project and not to have to depend on special budgets for particular projects, sporadically supported by top management, run by specific people (e.g., product champions), and/or being treated as unofficial.

**Discussing the development of a radical innovation project according to specific contexts.**

The literature, such as Gassmann, Widenmayer, and Zeschky (2012), discusses how to integrate different organizational forms, according to specific contexts:

- i) when the development of a radical innovation project is already in its advanced stages, for example, when at least one prototype is ready.
- ii) when it is viable to integrate necessary customer information, especially in the preliminary phases of the development of the radical innovation

project. It is what Gassmann, Widenmayer, and Zeschky (2012) call "*customers as voice of radical innovation projects development*".

However, not all innovation projects adhere to these contexts. These analyzed contexts might be valid for particular circumstances, for example, when they are related to large-scale product manufacturing with predefined customers and wishes, or when the radical innovation projects generate a new and unique product or service for a particular type of customer (a product developed on demand). Besides, it can be valid when customers can provide feedback about their needs which have not been met, and established firms can translate such necessities into something (e.g., prototypes) to be tested.

In other words, it is not always possible for the customers to act as the "voice of radical innovation projects development" (O'Connor, 2008). As Garcia and Calantone (2002) point out, it is common to observe radical innovation projects in which the potential customers are not always able to openly express their needs.

Despite these criticisms, these aspects show that some papers deal with important issues of organizational integration in established firms. The literature covers situations where the established firms try to minimize or even eliminate uncertainties (especially market ones), especially during the development of radical innovation projects, through specific integration mechanisms. According to Gassmann, Widenmayer, and Zeschky (2012), this is an attempt to reduce project uncertainties, especially market uncertainties. However, this situation requires two premises: first, that firms know who are the potential customers and establish hypotheses about their intentions and unfulfilled needs; and second, that the customer can express them. As announced by Garcia and Calantone (2002) and Leifer et al. (2001), these premises may not be valid in all radical innovation projects.

## **Group 02**

Gilbert (2002) and Christensen and Bower (1996) assert that radical innovation projects do not fit the criteria of the regular follow-up process in established firms, with the result that such projects are not accepted. The basis of the allocation of resources screens out project proposals that do not fit into the financial and operational criteria required to sustain the core business. Lettice and Thomond (2008) argue that established firms adopt rejection resource allocation strategies such as rewarding incrementalism,



ignoring positive aspects of disruptive opportunities, and focusing on historical perceptions of success.

According to Gilbert (2002) and Christensen and Bower (1996), when firms focus predominantly on the requirements of current customers in established markets, resource allocation mechanisms will refuse resources to explore new business opportunities. On the other hand, when the resource allocation focus is guided by a perception of threats to the core business, the firm will commit resources to explore new business opportunities. Recently, Kim, Kotha, and Fourné (2018) introduced another perspective for resource allocation in established firms, stating that, due to the difficulty of predicting whether a radical innovation project has market potential, the responsibility for decisions about allocating resources for these projects must take a “leap of faith” in supporting cutting-edge projects.

While traditional new product development occurs within the firm’s ongoing mainstream operations and processes, radical innovation projects all differ dramatically from those applied in the mainstream organization issues. It demand particular issues, such as: i) specific criteria for evaluating project progress, ii) appropriate alternatives for developing a budget and allocating resources, iii) distinguish market research, partnership development, prototyping, testing, and iv) different approach to customer development (O’Connor et al. 2008; Salerno & Gomes, 2008, Benner & Tushman, 2003)

As pointed out earlier, Burgelman and Valikangas (2005) and Kelley (2009) state, however, that the resource allocation for radical innovation projects needs to be perennial and must not depend on unsustainable arguments such as, “leap of faith” in terms of the responsibility for the resource allocation. Support for radical innovation projects in established firms often takes a cyclical path, shutting the funding down, and then restarting them again in a few years.

O’Reilly and Tushman (2008) and Teece (2006) look at ways of avoiding this cyclical path and believe that it is necessary for senior leaders to commit resources to long-term projects. The key to sustaining profitable growth is the ability to recombine and reconfigure internal and external resources from the firm as markets and technologies change. According to O’Connor et al. (2008), the main premise is to go beyond the

theoretical basis anchored in the resource-based view (Barney, 1991)<sup>14</sup>. Using the IF perspective, O'Connor (2008) considers that previous stocking of resources is not interesting to maintain leadership or competitive advantage during rapid or unpredictable change to continuously and systematically develop radical innovation projects. Therefore, rather than accumulating or previous stocking resources, capabilities should be developed to maintain the perennial resource allocation for radical innovation projects.

#### **2.4. Main Findings of the Literature Review**

The literature reveals that it is not possible to predefine all the necessary activities to conduct discovery, incubation and acceleration activities to develop radical innovation projects. As a consequence, as pointed out by O'Connor et al., (2008), it is not viable to predict the period necessary to project the development of the discovery, incubation and acceleration building blocks. As Leifer, O'Connor, and Rice, (2001) demonstrate, a project can require more than ten years of incubation to evolve correctly. There is no precise way to measure the necessary inputs and the scope of the firm's efforts. Furthermore, it is difficult (or even impossible in some situations) to predefine the output of these activities accurately, and, as a consequence, what is the next activity to be carried out. It is impossible to predict with a minimum of precision the time extension and the

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<sup>14</sup> There are at least two seminal works. Both Barney (1991) and Teece (1986) opened up new avenues for research throughout the last decades. According to Barney (1991), the existence of resources in the established firms is one of the strongest determinants of their competitive advantage. By resources, Barney (1991) considers all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc, controlled by a firm that enable it to conceive of and implement strategies that improve its performance, including physical capital resources (e.g., firm's plants, laboratories, equipment), human capital resources (e.g., experience, knowhow, relationships, insight of individual workers in a firm, and organizational capital resources (e.g., the firm's formal reporting structure, formal and informal planning, controlling, coordinating systems, informal relations between groups within a firm and between a firm and those in its environment).

Teece (1986) emphasizes the importance for innovating firms to take into account the complementary resources for the successful development and commercialization of an innovation. Complementary resources mean the infrastructure, knowhow, skills or capabilities especially present within the firm and that are necessary during the development of the innovation project. Complementary resources from classic organizational functions such as research and development, marketing, manufacturing, and sales are always needed. In this way, Teece (1986) claims that the established firms need to integrate all the necessary complementary resources to support the success of the development of high uncertainty innovation projects.

activities of the radical innovation project development. Consequently, it is also impossible to predetermine the resources necessary for project development.

O'Connor et al. (2008) and Salerno and Gomes (2018) state that the IF might not possess all the necessary resources to allocate to radical innovation projects. As pointed out earlier, there are at least three reasons: i) radical innovation projects are fraught with uncertainties, and initially defining what, when and how many resources are necessary might not be possible; ii) many resources may already exist in the parent firm, and it does not make sense to duplicate them; and iii) most radical innovation projects require resources, which can be used only a few times.

As consequence, O'Connor et al. (2008) argue that a successful IF performance needs to be integrated into, for example, the current organizational functions or business units to achieve financial resources, physical capital resources (e.g., the firm's plants, laboratories, equipment), and human capital resources from different backgrounds allocated within established firms (e.g., marketing, research and development departments). Govindarajan and Trimble (2005) call this phenomenon "borrowing resources".

This phenomenon opened the literature review of this dissertation and includes the search process and analysis from classic authors and current literature on how to integrate organizational functions. However, considering the classic authors, especially, Lawrence and Lorsch (1967), the main conclusions are not clear about adopting their principles for the integration of the IF. Initially, the points recommended by Lawrence and Lorsch (1967) are more related to incremental innovation projects than radical ones. For instance, the innovation projects and established firms analyzed by Lawrence and Lorsch (1967) demonstrate that is possible to define *a priori* the sequence of activities to be accomplished and the organizational departments (engineering, commercial, manufacturing, etc.) to be integrated, and as the development of the innovation projects is driven by linear sequencing, the customer's needs could be clearly specified at any time.

As has been pointed out, mainly during the current literature debate, these aspects found in Lawrence and Lorsch (1967) are not common in the development of radical innovation projects. Despite the contributions from classic and the current literature, the discussion on the integration of organizational functions is still scarce when it comes to

a specific organizational unit working with radical innovation projects and focused on continually exploring new opportunities, knowledge, products, and the market.

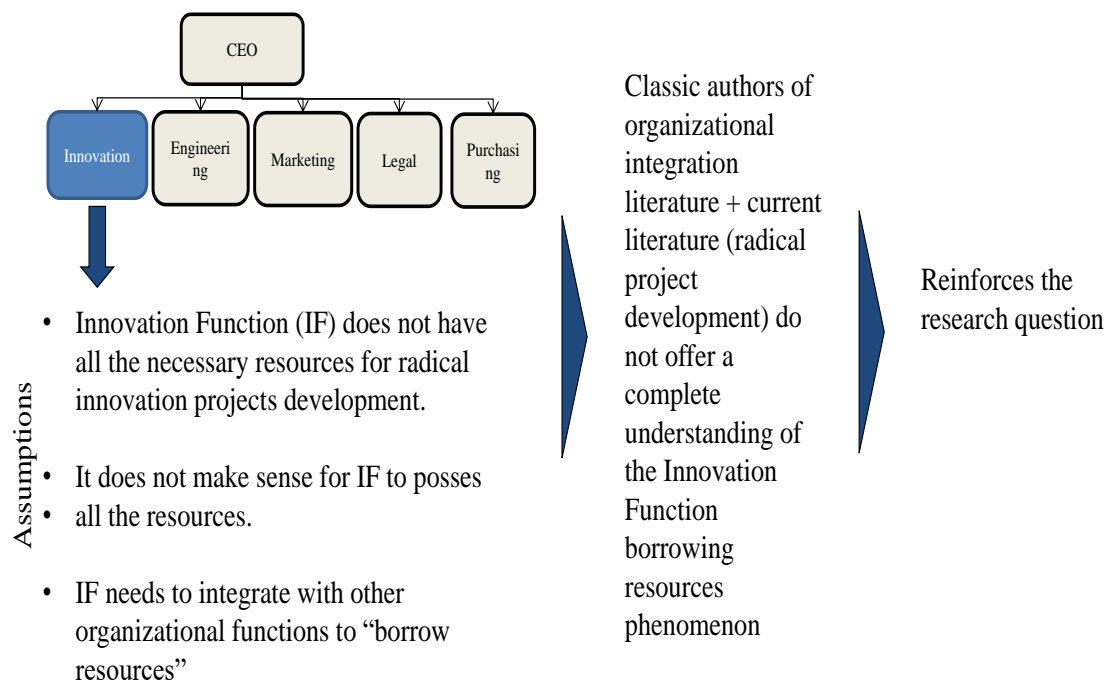
Comparing the classics with the current literature - Govindarajan and Trimble (2005), Raisch (2008), O'Connor et al. (2008) Tushman et al. (2010), Gassmann, Widenmayer, and Zeschky (2012) and Birkinshaw, Zimmermann and Raisch (2016) - firms have sought to develop radical innovation projects by exploring new markets and technologies. In many occasions, firms, however, discover opportunities to explore markets that do not yet exist. Therefore, it is important to question whether in the cases of radical innovation projects, the contributions pointed out by Lawrence and Lorsch (1967) are still valid. For example, how can integrators and/or other integration mechanism appointed by the classics contribute to integrate IF to borrow resources for radical innovation projects?

Despite the contributions from classic and the current literature, the discussion on the integration of organizational functions is still scarce when it comes to a specific organizational unit working with radical innovation projects.

Figure 12 seeks to synthesize the logic of findings from the literature review.

**Figure 12 - Overview of the conclusions of the literature review**

Illustrative Chart



Source: The author

For instance, the current literature appoints integration practices considering the necessity for resource allocation by obtaining high hierarchical level support, conducting internal mobilization of different organizational functions and gaining internal acceptance for the radical innovation projects. The discussions do not refer to perennial organizational function – as Innovation Function - to borrow resources.

As a consequence, the findings from the literature review reinforce the importance of discussing the research question of this dissertation:

**How do firms integrate the Innovation Function to borrow resources for radical innovation projects?**

The table 11 summarizes the mains aspects discussed by the classic authors and the current literature and its limitations.

**Table 11 - Summary of the mains discussed aspects in the Chapter 2**

|                           | <b>Sources</b>   | <b>Discussed aspects</b>   | <b>Limitations</b>  |
|---------------------------|--|--|---|
| <b>Classic authors</b>    | Lawrence and Lorsch (1973)<br>Galbraith, Downey and Kates (2001)   | <ul style="list-style-type: none"> <li>- Linear models for developing innovation projects: necessaries activities, resources, and organizational departments to be involved are predefined.</li> <li>- Customer needs could be clearly specified at any time.</li> <li>- Market share or the total sales could be estimated previously.</li> </ul>   | <ul style="list-style-type: none"> <li>- Not adherent to develop radical innovation projects.</li> <li>- Innovation development focused within the established firm, do not extending firms' boundaries.</li> <li>- Focused on developing incremental innovation projects.</li> </ul>   |
| <b>Current literature</b> | e.g., Gupta, Smith and Shalley (2006), Raisch (2009), Raisch et al. (2009), Tushman et al. (2010), Andriopoulos and Lewis (2010), Gassmann, Widenmayer, and Zeschky (2012), Slater, Mohr and Sengupta (2014), Birkinshaw, Zimmermann and Raisch (2016) | <ul style="list-style-type: none"> <li>- Predominance of non-perennial organizational forms, appointed as an alternative to the development of radical innovation projects (just one or few radical innovation projects, as a multifunctional project team).</li> <li>- strong dependence on project champions and/or sponsor from high hierarchical organizational level</li> <li>- Cyclical path for committing resources to radical innovation projects</li> <li>- Previous stock of resources is not interesting to maintain leadership or competitive advantage during rapid or unpredictable change for developing radical innovation projects continuously and systematically.</li> </ul> | <ul style="list-style-type: none"> <li>- Not-adherent to continuous and systematically development of radical innovation projects.</li> <li>- Limited to accumulate knowledge and capabilities, to build portfolios of radical innovation projects, manage them, and to increase the firm's expertise as experience accumulates.</li> </ul> |

Source: The author

## 2.5. Propositions and Conceptual Model

The literature review allowed to state the research question: **how do firms integrate the Innovation Function to borrow resources for radical innovation projects?**

In order to answer the research question, this dissertation considers three propositions, built according to the following arguments.

Initially it is important to remember that the IF integration to borrow resources can occur with different instances (e.g., C-Level, different Business Units - BUs, other organizational functions such as Marketing, Research and Development, Commercial, Engineering) (O'Connor et al. 2008; O'Connor, 2012; Bagno, Salerno, & Dias, 2017, Salerno & Gomes, 2018).

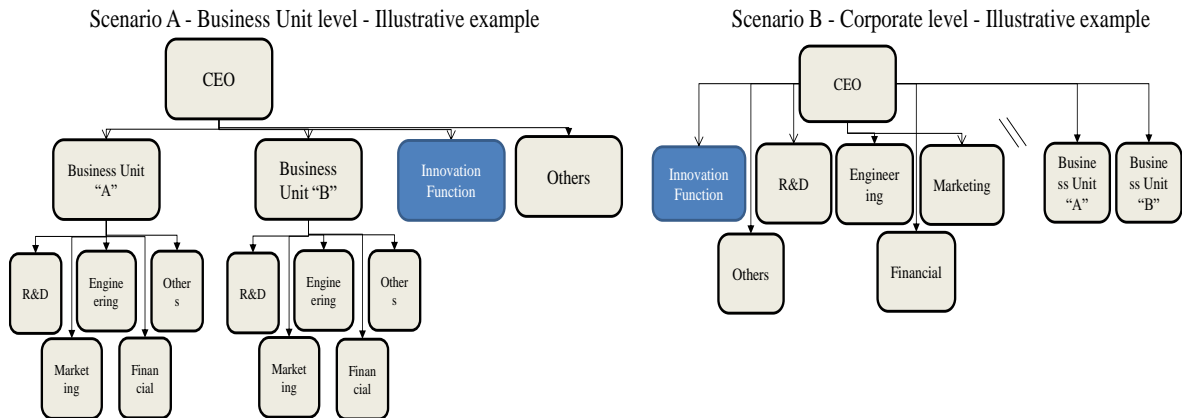
Two studies – Bagno (2014) and O'Connor & DeMartino (2006) - offers important insights for the first proposition. These two studies were the most detailed in clarifying the IF and its relationship within the firm. Bagno (2014) analyzed the IF in fifteen established Brazilian firms, and O'Connor and DeMartino (2006), based on a longitudinal study, analyzed twelve global established firms that have declared a strategic intent to evolve their radical innovation capabilities.

Analyzing both studies, this dissertation assumes that to borrow resources, IF can integrate in distinct ways. Most cases analyzed by Bagno (2014) and O'Connor and DeMartino (2006) portrayed two macro views of the organizational structures.

In some firms, each Business Units (BU's) is divided up into specialized organizational functions, such as research and development, commercial and engineering (scenario A – figure 13). These functions develop specific tasks according to each BUs interests. They report directly to the specific BU leadership. For example, if a firm's organizational structure comprises three BUs might exist three different R&D units. In a general perspective, these functions support the particular BU's ongoing operations (e.g., sales, manufacturing/production). In this dissertation, this functions are denominated as Business Units' functions.

Others firms, there are also, for example, research and development, commercial and engineering functions. They might report directly to the corporate level leadership (scenario B – figure 13), however, they support the current BU's. There are, for instance, the corporate R&D, commercial and engineering functions, which in this dissertation are denominated as Corporate's functions.

**Figure 13 - Overview of the distinguish most common organizational structures**



Source: The author

For this dissertation, the meaning of corporate and business units regards to Bowman and Ambronisni (2003)'s and Gupta and Govindarajan (1984)'s definition. Bowman and Ambronisni (2003) state that corporate level leadership includes the person responsible at the high hierarchical level of the established firms (e.g., C-Level of the firm, Vice-Presidents or directorship). One of the central role of the corporate level is to oversee, support or increase the primary activities of the Business Units. Established firms can be made up of multiple Business Units. For Gupta and Govindarajan (1984), a Business Unit is a profit center within the firm, which focuses on product offering and/or a market segment. Each BU is responsible for its own profitability and requires specific strategies, project portfolios, management skills, key success factors, competitive positions.

The figure 13 reveals that IF can need resources from Corporate level or Business Units. For example, it can demand resources from R&D laboratories or demand a group of engineerings, which report or belong to a specific current Business Unit or not. This aspect reveals a not simple situation to the efforts of IF's to borrow resources.

Considering BU's resources, O'Connor and DeMartino (2006) and Bagno (2014) appoint that IF has a hard task to deal with the business units to borrow technical



workforce, laboratories, and financial resources as it can inhibit exploratory activities of the radical innovation projects. The reason is simple. They state that IF has limitations to search for new business opportunities far from the plans of the business unit.

O'Connor and DeMartino (2006) discuss different innovation function's effort related to achieving corporate and business unit resources. They show that the financial corporate's resource can be necessary to fund promising RI projects that the business units cannot support. The human corporate's resource, on the other hand, can be necessary as a corporate board, like a technology council, to review opportunities beyond business unit's intention and resourced them with dedicated teams, or by implementing senior leadership coach team composed of the directorship members of the firm. O'Connor and DeMartino (2006) highlight a situation that these teams usually spend a combined 60 hours per month coaching, advising, and problem solving radical innovation project's team. They are accompanied by a staff of three or four coaches who help train the project teams in market learning, economic-modeling, and project-management approaches that are appropriate for radical innovation. O'Connor and DeMartino (2006) also show that infrastructure resources from corporate level can offer, for example, R&D laboratories to advancing radical innovation projects.

The practical reality discussed by O'Connor and DeMartino (2006) and Bagno (2014) shows that the IF might be also dependent on the existing BU's resources. These resources varies (e.g., human, financial and infrastructure). O'Connor and DeMartino (2006), for example, discovered some firm's cases that during a project incubation might be necessary to use the existing laboratories of the current business units. In these cases, during a specific period (temporarily), the assets of the laboratories and their human resources are destined to the radical innovation projects. These authors also discovered the existence of BU's leadership committees focusing on idea generation, initiating projects and funding them through early discovery to incubation. According to O'Connor and DeMartino (2006), in this situation, for example, a team of technical and business development middle managers of the business units starts trying to find new opportunities. As results of the initial fundings by BUs, some findings from the discovery regards to their strategic intent and others are non-related. These latter findings are directed to the corporate level of the firm for further funding and human resources allocation.

Whether the IF is depended on businesses unit or corporate resources, the integration of the IF within the parent firm is a necessary condition to borrow resources for radical innovation projects. In this way, this dissertation assumes that the integration to borrow resources from the business units and the corporate might occur, however, the integration might be different. Following this argument, the first proposition is:

**P.1.The integration of IF to borrow resources is different, when it borrows resources from the current business units, on one hand, and from the corporate, on the other.**

Based on one of the criticisms highlighted in Chapter 2, the second proposition is based on the following assumptions. :

- Despite the arguments from, Jansen et al. (2009), Tushman and O'Reilly (1996), that the top management teams (e.g., senior teams) ensure the necessary integration across different organizational functions to boost radical innovation project development. This dissertation considers, however, that is not sufficient.
- We support O'Connor et al. (2008) arguments that:
  - the development of radical innovation projects does not should only rely on the isolated actions of a narrow group of people or even a single one acting as a “champion”, supported by sponsors,
  - previous allocation of resources for radical innovation projects may not be a relevant aspect for IF. It is not consistent with the context of radical innovation projects. As pointed out earlier, Salerno and Gomes (2018) consider that many resources (especially the non-financial resources) may already exist in the parent firm or will be used only a few times, and so there is no need to duplicate them. Also, they consider that radical innovation projects have many uncertainties, and initially defining what, when and how many resources are necessary might not be possible.

Considering the examples discussed by Leifer et al. (2000) and O'Connor et al. (2008) from a selective group of innovative firms during the last twenty years, radical innovation project development might takes around many years. During these many years of

development (indefinable a priori) is also impossible to define previously, for example, all the necessary resources, activities and their duration. Furthermore, as the examples discussed by Leifer et al. (2000) and O'Connor et al. (2008) the resources destination for radical innovation projects in firms often takes a non-regular path, shutting the funding down, and then restarting them again in a few years later. In some situation, there are changes in the project leaders, scope of activities, sponsors, and funding).

Our claims consider that prior allocation resources for radical innovation projects are not enough and the existence of product champions and high organizational level support are not sufficient to guarantee the necessary resources for radical innovation projects. Lettice and Thomond (2008), Sandberg and Aarikka-Stenroos (2014) and Bessant, Oberg, and Trifilova (2014) appoint that one relevant aspect for such guarantee regards to the firm's capacity to overcome internal and external barriers.

Sandberg and Aarikka-Stenroos (2014), for example, identified 103 papers focused on Radical Innovation project barriers and divided these into six main barriers. The first four are internal barriers to the firms and the last two are external barriers.

- “restrictive mindset”: fear and/or resistance of innovations within the firm; seen, for example, in fear of change, fear of failure, conservative decision-making, and restrictive organizational culture.
- “lack of important innovation competences”: incapacity to perform the DNA Model as proposed by O'Connor et al. (2008), for example, being unable to discover new ideas; in incubating relevant projects; difficulties of moving projects from the incubation phase to acceleration.
- “insufficient resources”: lack or misallocation of internal finance, skills, experience, information, or tools within the firm.
- “unsupportive organizational structure”: hierarchical arrangement of lines of authority, communications, rights, and responsibilities in the firm.
- “resistance or lack of support from specific actor”: such as customer resistance, unsupportive government, lack of finance available, and/or resistant investor.
- “restrictive external environment”: such as economic crisis, undeveloped network and ecosystem, technological turbulence, inadequate constellations of supply and distribution chains.

According to Sandberg and Aarikka-Stenroos (2014) the internal barriers originate within a firm and vary, according to the contingent to its management and organization.

External barriers originate from a firm's external environment and emerge when a firm interacts with other organizations or actors in economic and innovation systems; these include issues relating to, for example, the behavior of competitors, customers, partners, and governments.

Sandberg and Aarikka-Stenroos (2014) and Bessant, Oberg, and Trifilova (2014) highlight that to maintain perennial resource allocation for radical innovation projects, firms need to be able to overcome barriers. Overcoming barriers is not a simple undertaking. In this way, this dissertation takes into account that IF needs to be able to struggle for perennial resource allocation to radical innovation projects, by borrowing the resources<sup>15</sup>.

Therefore, the second proposition states that:

**P.2. Instead of the prior destination of resources for radical innovation projects, or merely the existence of product champions and the high organizational level support, IF need to be able to struggle to borrow resources.**

The third proposition is based on classic authors. Even though the criticisms pointed out in Chapter 2, the classics can offer valuable contributions to discuss the research question. This dissertation assumes that the classics, despite having been written many years ago, may help to explain current phenomena. This premise refers mainly to Tushman and O'Reilly (1996). They remember that several decades after the initial findings of Lawrence and Lorsch, who started publishing their findings on organizational integration in the sixties, the concepts of differentiation and integration continue to interest business scholars studying a wide variety of problems such as structural ambidexterity. Raisch et al. (2009), O'Reilly and Tushman (2013), Benner and Tushman (2015), and Birkinshaw, Zimmermann, and Raisch (2016), for example, point to the contributions of Lawrence and Lorsch (1967).

As noted on topic 2.3.1.2 (from pages 40 to 44) there are different integration mechanisms (e.g., networks, lateral processes, integrative roles, integration managers, matrix structure, integrative team, which comprises cross-business teams, task force teams and committee teams and formal hierarchy). Considering the organizational

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<sup>15</sup> In this dissertation, as the data from the case studies reveal (see more details on topic 5.4. from pages 163 to 171) the struggle means the IF team activities to deal with the side effects or overcome the barriers of to borrow resources for radical innovation projects.

integration for developing radical innovation projects, Van Burg et al. (2012), Jansen et al. (2009), Cantarello, Martini and Nosella (2012), highlight the integrators' role - responsible for integration previously pointed out by the classics, Lawrence and Lorsch (1967) and Galbraith, Downey and Kates (2001). The integrators, as mentioned by Lawrence and Lorsch (1967), are an employee or a team responsible for functional integration, who ensures that the work of each units fits in with the overall business objectives and that resources within the organization are optimally leveraged and coordinated between units.

Assuming that Galbraith, Downey and Kates (2001) remember that integration is necessary, for example, to align different organizational functions around the firm's priorities and strategies, to allocate resources to the organizational functions and to solve conflicts over the use and allocation of these resources, integrator mechanisms might be necessary to the struggles of IF to borrow resources.

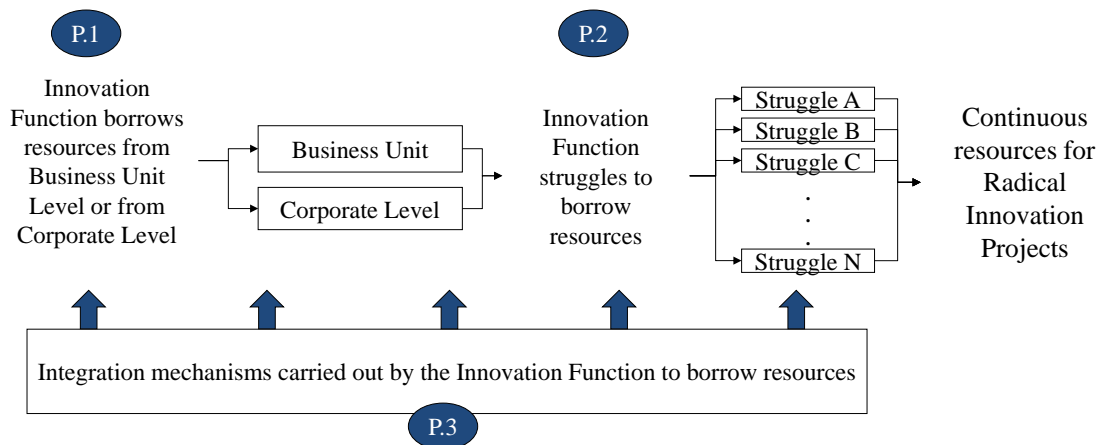
Then, this dissertation assumes that the integration mechanisms are suitable and might vary according to the struggles that the innovation function needs to face. In this way, the third proposition is:

**P.3. The integration mechanisms, as appointed by the classics authors, are essential, but they need to be used by IF to face the struggles to borrow resources.**

These three propositions were extracted from the literature review, are linked, as indicated in Figure 14, and sustain the conceptual model.

**Figure 14 - Conceptual Model**

How do firms integrate the innovation function to borrow resources for radical innovation projects?



Source: The author

The final result is to permit the continuous (perennial) resources for radical innovation projects. Although many radical innovation projects will not succeed in the development phases, and, as O'Connor (2012) and O'Connor et al. (2008) state, even though there is a deceleration of resources for radical innovation projects in times of crisis, the radical innovation project development does not wholly disappear. The IF continues, just as the commercial, financial, and production areas do not disappear in times of crisis.

### **3. Methodology**

We conducted an inductive study using multiple case research design. Given the nature and aims of the research, multiple case studies are appropriate (Eisenhardt, 1989). Yin (1994) and Eisenhardt (1989) explain that multiple cases studies can discern how each case either confirms or fails to support the inferences, resulting in more robust theory findings. The case studies conducted in this dissertation were especially inspired by Eisenhardt (1989) and Voss, Tsikriktsis and Frohlich (2002), and Yin (1994). Our unit of analysis is radical innovation projects. More specifically, the research is focused on the integration practices of IF to borrow resources for radical innovation projects.

Following Voss, Tsikriktsis and Frohlich (2002), we adopted retrospective case studies, which are appropriate when it is necessary to collect archival and/or historical data. Such studies look back at events that took place or works that were produced in the past, allow for more controlled case selection and can identify cases that reflect success or failure only in retrospect. Our methodological approach is very similar to Westerman, McFarlan, and Iansiti (2006), Andriopoulos and Lewis (2009) Gassmann, Widenmayer, and Zeschky (2012), and Chen and Kannan-Narasimhan (2015).

This dissertation was oriented by the steps described by Eisenhardt (1989). She defines eight steps for building theory from case study research: i) getting started, ii) selecting cases, iii) crafting instruments and protocols, iv) entering the field, v) analyzing data, vi) shaping hypotheses, vii) enfolding literature and viii) reaching closure.

The table 12 characterizes each step according to Eisenhardt (1989) and points out where the content of each step can be found in this dissertation.

**Table 12 - Case study steps according to Eisenhardt (1989) and the application in this dissertation**

| <b>Step</b>                               | <b>Main activities</b>  | <b>Dissertation topic</b>                       |
|---|---|---|
| <b>Getting start</b>                      | Conduction of the literature review process necessary to define at least two aspects: research question and propositions.   | Chapter 2                                       |
| <b>Selecting case</b>                     | Definition of the population and criteria to prioritize the cases. Efforts on theoretically useful cases- i.e., those that replicate or extend theory by filling conceptual categories. | Topic 3.1.                                      |
| <b>Crafting instruments and Protocols</b> | Definition of multiple data collection methods (e.g., qualitative and quantitative data combination).   | Topic 3.2.                                      |
| <b>Entering the field</b>                 | Initial data collection.  | Topic 3.2                                       |
| <b>Analyzing Data</b>                     | Analysis comprising within-case and cross-cases.  | Topic 3.3 and Chapter 4                         |
| <b>Shaping Hypothesis</b>                 | Iterative tabulation of evidence for each construct. Replication, not sampling, logic across cases (confirms, extends, or sharpens theory).   | Chapter 2, mainly the topic 2.5, and Chapter 05 |
| <b>Enfolding literature</b>               | Comparison with conflicting literature and with similar literature.   | Chapter 5                                       |
| <b>Reaching closure</b>                   | Ending process (e.g., when theoretical saturation is achieved).   | Chapters 5 and 6                                |

Source: The author based on Eisenhardt (1989)

Eisenhardt (1989) dedicates a specific step called “shaping hypotheses”, which is one of her final steps. She aims to use case studies for theory building research and argues for entering the field and analyzing data with no a priori hypotheses. For example, Marting and Eisenhardt (2010) followed the methodological guide prescribed by Eisenhardt (1989) and built a theoretical framework based on theories of multibusiness organization, including complexity theory and large firms as complex adaptive systems. Their theoretical framework explains how executives create cross-business-unit



collaboration that generates high value creation by established firms. The end of their paper includes five propositions which can be explored in further studies. As we noted, the methodological steps of this dissertation are inspired by Eisenhardt (1989) and other studies (e.g., Voss, Tsikriktsis, & Frohlich, 2002; Yin, 1994). We adopted the building of the propositions at the beginning of the study (getting started) and we built propositions before building the research protocol and starting the data collection, but we do not integrally use all her recommendations of Eisenhardt (1989). Integrally adopting Eisenhardt (1989) would be necessary if the dissertation ended by pointing out a set of propositions to be further tested, but this dissertation aims to point out a set of combined propositions and then test them.

Although the steps to conduct this research suggest a linear approach, scientific research takes a far from a linear process. As pointed out by Voss, Tsikriktsis, and Frohlich (2002) loops, feedbacks and returning to early steps to reformulate assumptions, constructs, relations and even the research question are natural occurrences in scientific activities. In this way, this chapter discusses how the selection of the cases (topic 3.1), the research protocol adopted (topic 3.2) and how the analysis of the data were conducted (topic 3.3).

### **3.1. Selecting cases**

We can divide the second step of the study (“*selecting cases*”) into two phases. At the beginning (first phase), we highlighted the necessity to conduct a preliminary study and then making the further research (second phase).

In the first phase, we were interested in finding established industrial firms recognized as innovators and, for operational reasons, acting in Brazil. The seven selected firms comprised a sample of industrial firms making efforts to develop radical innovation projects. The sample contained industrial firms from different sectors, recognized inside and outside Brazil as innovative firms. The first phase aimed to identify the occurrence of the IF as described by O’Connor et al. (2008) and the existence of the radical innovation project portfolios<sup>16</sup>. The first phase was a filtering phase as we were interested in the cases that stood out.

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<sup>16</sup> Considering the extended radical innovation definition: radical innovation as *stricto sensu* + really new innovation.

The first phase started in May, 2016. Initially, three industrial firms were selected. Then a second round in 2017 included another four firms. The seven firms were found by accessing the network of the researcher and his colleagues, scanning news published in the press, conferences or national awards. The seven firms are denominated here as Electronics, Basic Chemistry, Generic Pharm, Cosme, Quim, CompAuto and Pharm.

However, in four firms, Electronics, Basic Chemistry, Cosme and Generic Pharm, the radical innovation project portfolios were not robust, with just one project (with no portfolio) or comprises a group of embryonic radical innovation projects, with no defined or borrowed resource allocation. Embryonic projects, in this case, mean just a list of conceptual ideas for radical innovation projects. Despite the existence of a group responsible for discovering new business opportunities, based on radical innovation projects, the group was just initiating its activities.

Thus, these four firms were eliminated of the detailed analysis and were not considered during the second phase of the study (Chapters 4 and 5). A firm with just one radical innovation project could not express the existence of the IF. It might reveal sporadic development of radical innovation projects, which might be dependent on special budgets and people (e.g., champions), or are treated as unofficial projects (Bagno, 2014; O'Connor et al., 2004). Besides, a firm with an innovation area with just embryonic radical project portfolios (ideas) is not appropriated for our study, we search for IF performing with a cumulative knowledge and successful projects.

As will be discussed in the following chapters, the second phase demanded a more detailed study. The three firms in the second phase, Quim, CompAuto, and Pharm, are a sample of established industrial firms which have been attempting for at least 10 years to systematically and continuously develop radical innovation projects. The table 13 summarizes the content of the selected cases.

**Table 13 - Selecting the cases**

| <b>Firm</b>                                     | <b>Is there a radical innovation portfolio?</b> | <b>Details</b>  |
|---|---|---|
| <b>Compauto</b>                                 | Yes   | - At least two portfolios of Radical Innovation Projects.<br>- Historic of discovery and incubation activities managed by the Innovation Function<br>- Historic of IF borrowing resources for Radical Innovation Projects |
| <b>Pharm</b>                                    | Yes   |   |
| <b>Quim</b>                                     | Yes   |   |
| <b>Electronics</b>                              | No  | Just one project at the incubation phase.   |
| <b>Generic Pharm, Basic Chemistry and Cosme</b> | No  | An embryonic portfolio of radical innovation projects. At this moment, no relevant resource borrowing efforts.  |

Source: The author

Thirty four interviews were made with different members of these seven firms, workers involved in managing radical innovation projects but who have different roles, such as director of radical innovation, the manager of radical innovation portfolio, the innovation manager or coordinator, and the manager of the research laboratory. Table 14 shows an overview of the interviews. The Appendix 2 shows the details (duration, presentational or not, interviewees, firms) of these interviews.

**Table 14 - Overview of the interviews**

| <b>Firm</b>            | <b>Number of interviews</b> | <b>Number of interviewed</b> | <b>Interviewed</b>   | <b>Total duration (minutes)</b> |
|------------------------|-----------------------------|------------------------------|--|---------------------------------|
| <b>Electronics</b>     | 2                           | 1                            | Director of New Businesses   | 100                             |
| <b>Basic Chemistry</b> | 1                           | 2                            | R&D Manager<br>R&D Researcher  | 90                              |
| <b>Generic pharm</b>   | 3                           | 2                            | Scientific Director<br>R&D Manager   | 210                             |
| <b>Cosme</b>           | 5                           | 3                            | Portfolio Manager<br>Innovation Process Manager<br>Global Director of New Product Development  | 250                             |
| <b>Pharm</b>           | 7                           | 5                            | Radical Innovation Director<br>(#2) Portfolio Managers<br>Integrator manager<br>R&D researcher | 590                             |

|                 |    |    |  |      |
|-----------------|----|----|--|------|
| <b>CompAuto</b> | 10 | 5  | Global Manager of New Business Platforms<br>Incubation Portfolio Coordinator<br>Product Technology Manager<br>(#2) Researchers | 605  |
| <b>Quim</b>     | 6  | 3  | Innovation and Knowledge Manager<br>Innovation Coordinator<br>Innovation Analyst   | 425  |
| <b>Total</b>    | 34 | 21 |  | 2270 |

Source: The author

### 3.2. Research Protocol

The research protocol presents the data collection instrument (questionnaire) and describes the procedures followed by the researcher for data analysis. It also increases reliability and validity in the way the case study was conducted (Voss, Tsikriktsis, & Frohlich, 2002) since it allows the study to be replicated by another researcher (Yin, 2010).

The core of the research protocol refers to the second phase of the research, which offers all data necessary to build Chapters 4 and 5. The research protocol guides the second phase and is shown in the topic 3.2.

It is also necessary to explain how the first phase of the research was conducted. This phase was necessary to select the firms which were most appropriate for this dissertation. The first phase of the research included seven firms. To collect the data of this phase an interview with a firm's representative (manager or director) responsible for innovation projects was initially made. In order to find the ideal workers to be interviewed, the network of the research group and the scanning of awards and news in the press were used. The first contact consisted of a 60-minute interview at the beginning of the data collection and included the following aspects:

- Understanding what the main radical innovation projects developed (during the last years) or ongoing radical innovation projects are. How these projects originated and who were the internal people responsible for the development of the projects.

- Clarifying whether there is an internal team responsible for identifying, structuring and searching for resources for radical innovation projects.

These aspects allowed us to select the firms which can be more related to the objectives of this dissertation.

In order to collect primary data, we conducted retrospective interviews. They were recorded and transcribed in full. After each transcription, a report was prepared with all the information and highlighted the main aspects connected to this dissertation. The data collection process also included other academic papers and dissertations from the LGI USP (research group<sup>17</sup>) team. It was important to incorporate prior data, especially at the beginning of the research. For example, the dissertations of Bagno (2014) and Silva (2016) provided essential data. Bagno (2014) extensively maps the IF in several established innovative firms in Brazil, and two (CompAuto and Quim) of the three cases discussed in this dissertation were the object of Bagno's (2014) study. Silva (2016) makes a detailed study on managing innovation project portfolios in Quim. Besides, several LGI USP publications were also analyzed as secondary sources<sup>18</sup>.

The research protocol refers to collect data from the selected firms (Quim, CompAuto, and Pharm) and consists of three sections.

Section A: Overview of the Case Study;

Section B: Procedures for Data Collection;

Section C: Semi-structured questionnaire used in the interviews.

This research protocol was initially applied with the members of Quim and CompAuto. This application was necessary to validate the research protocol and consisted of two meetings: i) a face-to-face meeting (on 10/11/2017) and a conference call (on 11/07/2017) with two members of the innovation and knowledge manager's team

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<sup>17</sup> Laboratório de Gestão da Inovação (LGI) – Departamento de Engenharia de Produção da Escola Politécnica da USP – [www.pro.poli.usp.br/lgi](http://www.pro.poli.usp.br/lgi)

<sup>18</sup> CompAuto has been the object of longitudinal studies since 2008 by the LGI research team. During this period, the LGI research team conducted interviews with the VP, innovation director, PMO, and senior researchers. Similar situations occurred in the Quim case, which has been object of a longitudinal study since 2007. The main activities carried out are: interviews with the CEO, VPs, Directors, champions, IF middle managers, business unit leaders, workshops with the whole IF function at the university, discussion in the innovation committee, visits to plants and labs, supervision of students doing dissertations on and involved in projects with the company.

(Quim); and ii) a conference call (11/22/2017) with the Incubation Portfolio Coordinator (CompAuto). These two interviews were necessary to show the aims of the study, check the adherence of the questions, clarify doubts, and identify workers within the firms who could contribute to the research.

**Table 15 - Research Protocol**

**Section A - Overview**

|  |  |
|--|--|
| <p>Basic Information /<br/>Theoretical framework</p> | <p>Innovation Function concentrates a primary group of activities: has its own core body of knowledge, hierarchy, leadership, location in the organization chart, goals and deliveries. This dissertation considers Innovation Function as an organizational form separated within the parent firm. It aims to manage radical innovation project portfolios to build up the capabilities necessary to develop radical innovation systematically and continuously (O'Connor et al., 2008, O'Connor, 2012, Bagno, Salerno, &amp; Dias, 2017, Salerno &amp; Gomes, 2018).</p> <p>According to O'Connor et al. (2008) radical innovation is “the innovation that offers either new to the world performance features or significant improvement (5–10 times) in known features or significant reductions (e.g., 50%) in cost, such that new application domains would open up; However, in this dissertation the radical innovation concept is understood as an extended perspective (O'Connor, 2008) -, including radical innovation <i>stricto sensu</i> (O'CONNOR et al., 2008) and also and really new innovation (Garcia &amp; Calantone, 2002; O'Connor, 2008).</p> <p>O'Connor et al. (2008) state that to avoid the decelerating or canceling movement of radical innovation projects, the IF needs to struggle to guarantee the necessary resources for radical innovation projects throughout all their development activities.</p> <p>This dissertation adopts <i>resource</i> as a concept from Barney (1991). It means physical capital resources (e.g., firm's plants, laboratories, equipment), human capital resources (e.g., experience, know-how, relationship) and financial resources for the project development.</p> <p>The term “borrow resources” is adopted by the literature (Govindarajan &amp; Trimble, 2005). In this dissertation, it refers to the necessity of IF to obtain resources (e.g., human resources, infrastructure, such as equipment and laboratories) within the parent firm for the radical innovation projects development. It does not refer only to financial resources, but, especially for example, to internal laboratories, equipment, human resources (Govindarajan &amp; Trimble, 2005). As explained by Salerno and Gomes (2018), radical innovation projects are fraught with uncertainties, and initially defining what, when and how many resources are necessary might not be possible. Furthermore, they point out that many resources may already exist in the parent firm or will be used only a few times, and so there is no need to duplicate them.</p> <p>To develop the capacity to borrow internal resources, the IF might be integrated with the business units or the corporate level. This integration to borrow resource is a relevant alternative to achieve the perennial resource allocation for radical innovation projects (Govindarajan &amp; Trimble, 2005; O'Connor et al., 2008; Salerno &amp; Gomes, 2018). Despite this relevance portrayed by the literature, however, the debate is still scarce and does not explore in details how IF might borrows resources from the parent firm for the radical innovation projects.</p> |
|--|--|

|   |  |   |  |  |
|---|--|---|--|--|
| Important Questions   | <ul style="list-style-type: none"> <li>• How does the Innovation Function achieve internal resources?</li> <li>• How do the business unit and the corporate leadership lend resources to Innovation Function?</li> <li>• Are there differences between borrowing financial and non-financial resources? How do these difference occur? What can explain this difference?</li> <li>• Which integration practices does the Innovation Function can adopt?</li> <li>• How are the main challenges the Innovation Function needs to face to borrow resources for radical innovation projects?</li> </ul> |   |  |  |
| Objectives of the research  | <p><b>General objective:</b><br/>Explain how the Innovation Function integrates within the parent firm to borrow resources for radical innovation projects.</p> <p><b>Specific objectives:</b><br/>Identify the integration practices of the Innovation Function to borrow resources.<br/>Explain how the different integration practices contribute to borrowing resources.<br/>Establish categories of borrowing resources by the Innovation Function.</p>   |   |  |  |
| Objective of the research protocol  | Guide the researcher action to perform an exploratory research.  |   |  |  |
| <b>Seção B: Procedures to collect the data</b>  |  |   |  |  |
| <b><u>Research Question</u></b>   | <b><u>Propositions</u></b>   | <b><u>Sources</u></b>   | <b><u>Threats to validation</u></b>  | <b><u>Expected findings</u></b>  |
| How do firms integrate the Innovation Function to borrow resources for radical innovation projects? | <p>P.1.The integration of IF to borrow resources is different, when it borrows resources from the current business units, on one hand, and from the corporate level, on the other.</p> <p>P.2. Instead of the prior destination of resources for radical innovation projects, or merely the existence of product champions and the high organizational level support, IF need to be able to struggle to borrow resources.</p>  | Interviews and secondary sources provided by the firm, such as documents or systems. Check the website of firm on the Internet. | No access to the most appropriate people to be interviewed;<br>Misunderstanding specific vocabulary or uncorrect interpretation of primary data;<br>Do not get the complete information when it is a strategic issue for the business. | <p>Integration practices adopted by the IF to borrow resources for radical innovation projects;</p> <p>Different approaches for borrowing resource chose by the IF;</p> <p>Distinguishes alternatives to borrow resources.</p> |



|                                      |   |  |  |  |
|--------------------------------------|---|--|--|--|
|                                      | P.3. The integration mechanisms, as appointed by the classics authors, are essential, but they need to be used by IF to face the struggles to borrow resources.   |  |  |  |
| Prior preparation for the interviews | <ul style="list-style-type: none"> <li>• Prepare a semi-structured questionnaire based on previous literature review that will guide the collection and analysis of the data</li> <li>• Identify candidate firms.</li> <li>• Identify the profile of the interviewees.</li> </ul>   |  |  |  |
| Who will be interviewed?             | <ul style="list-style-type: none"> <li>• People involved in the development of radical innovation projects: the involvement should include, but are not limited to: project portfolio management, business unit or corporate leadership, management of an organizational department (such as engineering or research and development), project management.</li> </ul>                       |  |  |  |
| How to select the cases              | <ul style="list-style-type: none"> <li>• Established industrial firms recognized as innovator. Not random sample, comprising of firms, which are conducting efforts to develop radical innovation projects. The sample need to permit identifying the occurrence of the IF as described by O'Connor et al. (2008) and the existence of the radical innovation project portfolios</li> </ul> |  |  |  |
| Researchers' role                    | Collect data through interviews with various workers of the firm to avoid bias. Collect secondary data provided by the firm and available on the Internet.  |  |  |  |
|                                      |   |  |  |  |

**Section C: Data Collection**

Questions / Points of the interview

- A. Data on the respondent:**
- What is your role in the firm? How long have you been in this role?
  - How many years have you been involved in innovation projects in your firm?
- B. Characterization of the firm:**
- Talk about your firm (number of employees, business segments).
  - Talk about the main products of the firm (number of products, types of products).
- C. Characterization of innovation projects:**
- What are the firm's main innovation projects? Give examples.
  - Are innovation projects divided (grouped) in any way (eg., portfolio)?
  - If so, what is this division? Who is responsible for such projects? How was this division established?
- D. Characterization of the development of innovation projects:**
- Talk about the main stages and activities to develop an innovation project.
  - How does an innovation project start?
  - What are the main areas involved? Who are involved in each main stages and activities?
  - Are these main stages and activities similar for all the innovative projects?
  - Do the more innovative projects follow the same stages and activities? If not, what are the main differences?
- E. Characterization of the Innovation Function:**
- Do the most innovative projects be under the management of what internal areas and people?
  - To whom do such areas and people report?
  - What are the main roles of each of these areas and people?
  - Who is responsible for creating and identifying opportunities that may have the greatest impact in the marketplace?
  - Give examples of identified opportunities.
  - Who is responsible for developing new business models for the identified opportunities? Cite examples of such new business models.
  - Who is responsible for developing and testing market and technology hypothesis for the identified opportunities? Give examples of such actions.

|                          |   |
|--------------------------|---|
|                          | <ul style="list-style-type: none"> <li>• Who does analyze the infrastructure, the processes required (such as manufacturing and order delivery, customer contact, and support) after business modeling? Give examples.</li> </ul> <p><b>F. Characterization of the integration of the Innovation Function with the other internal areas</b></p> <ul style="list-style-type: none"> <li>• Talk about how those responsible for managing most innovative projects interact with other areas of the firm.</li> <li>• What are these areas? What are their main contributions?</li> <li>• What are the main actions to interact? (Periodic meetings, innovation committees, forums)?</li> <li>• Talk about how top management is involved.</li> </ul> <p><b>G. Characterization of resources for radical innovation projects</b></p> <ul style="list-style-type: none"> <li>• When do the most innovative projects begin, how is resource allocation defined? Who participates? Who decides on the initial resources?</li> <li>• How are defined financial and non-financial resources (eg., labor, infrastructure, laboratories, pilot plant) for the most innovative projects?</li> <li>• How are resources allocated for the most innovative projects?</li> <li>• Is there a prior definition of resources? Does it meet the needs of projects? If not, what actions will be taken to meet additional needs? Who are involved? Who makes the decisions?</li> <li>• Give examples of situations where additional resources were required.</li> <li>• In the examples mentioned, did conflicts arise? If so, how were they solved and who was involved in resolving conflicts? Give examples.</li> </ul> |
| Interview procedures     | <ul style="list-style-type: none"> <li>• Identify the key people for the interviews.</li> <li>• Get the details to contact these people.</li> <li>• Schedule meetings to conduct interviews.</li> <li>• Check the possibility of conducting interviews in person or remotely.</li> <li>• Send the questions in advance.</li> <li>• Try to get at least two respondents present.</li> </ul>  |
| Transcription procedures | <ul style="list-style-type: none"> <li>• Record the interviews (if the respondent allows).</li> <li>• Take notes during interviews, and when possible, with the support of at least one additional interviewer.</li> <li>• After the interviews, write a complete report (transcribe all collected information)</li> </ul>  |

Source: The author

### **3.3. Analyzing Data**

#### **3.3.1. Contextualization**

As stated by Eisenhardt (1989) and Voss, Tsikriktsis and Frohlich (2002) this step of analyzing data is the heart of the case studies, the most difficult and the least codified. These certain actions were adopted: i) writing a descriptive report of each firm (Quim, CompAuto, Pharm); ii) building within case analysis; iii) building cross-case analysis.

We also followed suggestions from Eisenhardt (1989) and selected different categories to look for within group similarities, and then look for within group similarities coupled with intergroup differences. Each category is described in Chapter 4: i) characterization of the IF chart and project portfolios for each firm; ii) reasons observed that explain why the IF needs to borrow resources for each firm; and iii) identification of the integration practices for the IF to borrow resources for each firm.

During the data analysis, we also tried to follow two other important aspects highlighted by Eisenhardt (1989): i) comparing with conflicting literature, ii) comparing with similar literature.

To organize all the findings a report was produced, which included the transcribed audio of all interviews and the main findings. It was important to adjust the data collection process as the research evolved. For example, additional adjustments were made to data collection instruments (e.g., changing questions of the research protocol). As pointed out by Eisenhardt (1989), these adjustments are normal and necessary to improve the research findings.

We adopted semi-structured questions (Research Protocol, topic 3.2) to analyze how the Innovation Function borrows resources for the radical innovation project portfolios. As Voss, Tsikriktsis and Frohlich (2002) explain, the semi-structured questions permit us to understand aspects that are not predictable before starting an interview to collect primary data.

### **3.3.2. How the analyze was performed**

The central aspect here is to explain how the data were analyzed. As noted, the data came from the application of the research protocol to Quim, CompAuto and Pharm employees. The analysis used ideas from Eisenhardt (1989), who suggests a continuous reflection about the data that are analyzed. She highlights to ask, for example, “What am I learning from the cases?” and “How does this case differ from the last?”. These two perennial reflexions guide the building of Chapters 4 and 5.

In this, way, we created the following analysis: for each proposition, we tried to: i) identify the main elements of each case, based on the three propositions of this study; and ii) compare the similarities and differences between the cases.

According to Proposition 1, we assume that the integration of the IF is not the same when it borrows resources from the business unit, on one hand, and from the corporate level, on the other. However, we did not know how the integration could differ.

We noted in each firm that the person responsible for the allocation of financial resources to radical innovation projects varies. In some cases (CompAuto and Pharm) the area responsible for funding the projects is the corporate leadership (C-level), while at Quim the area responsible is the business unit leadership. Furthermore, IF has an own budget for funding the beginning of the projects (mainly discovery in Pharm), while at Quim the business units must be interested and finance the projects, at least in the discovery-incubation phases. Therefore, the characteristics of the “borrowing” are different in each case. This differentiation requires different integration practices for the IF. As will be mentioned in Chapters 4 and 5, just allocating the financial resources to the IF is not enough as the IF also needs to borrow non-financial resources such as laboratories, pilot plants or hours of work of specialized people (like engineers, chemists, pharmacists, etc.) for radical innovation projects.

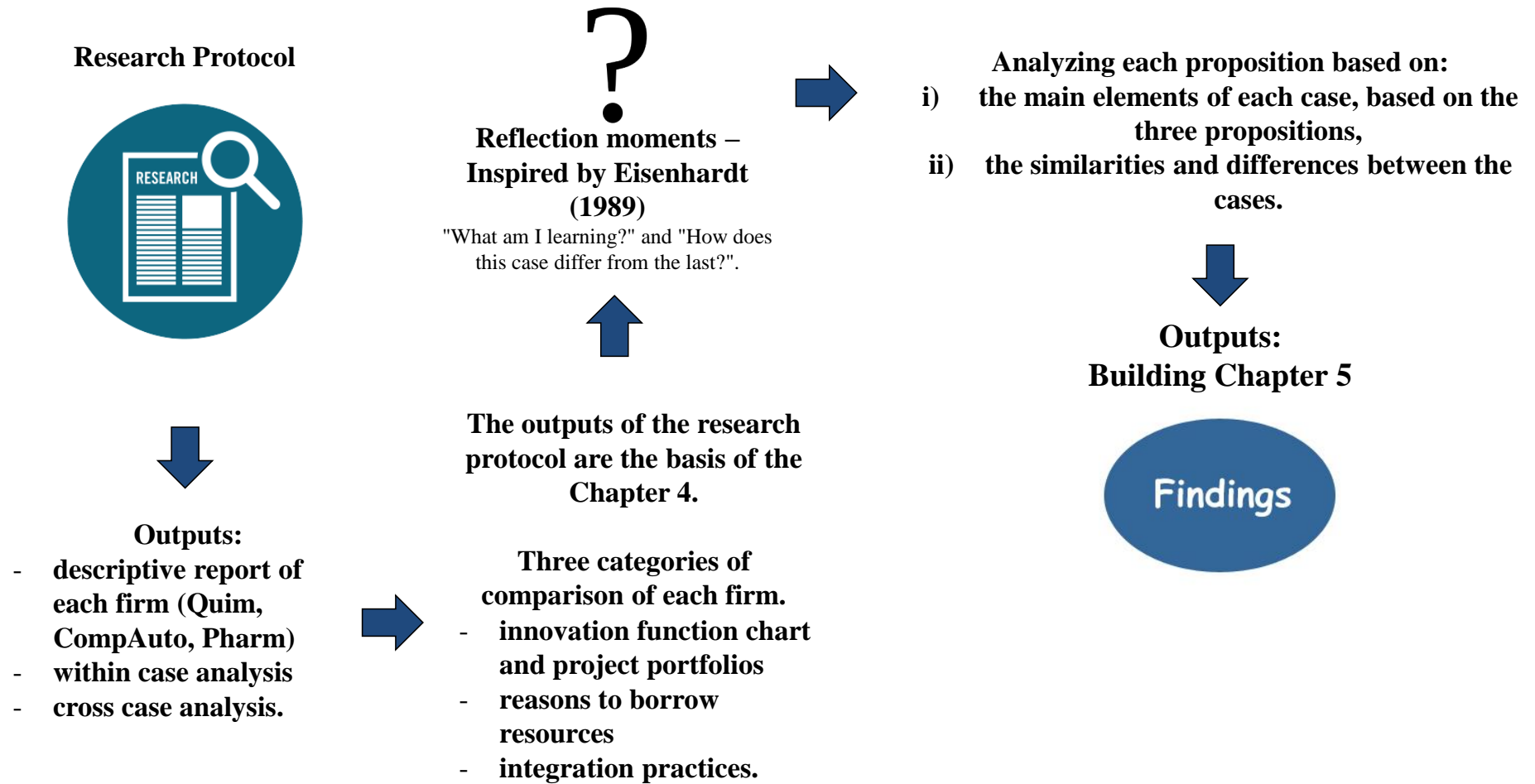
The first analyses identified four approaches for the Innovation Function to borrow resources. Quim shows two approaches, CompAuto and Pharm one each. As a consequence, we coined the term “approach to borrowing resources” as a relevant construct, which could contribute to analyze Propositions 1 and 2. According to Proposition 2, to explain what type of struggle and how the struggles influence each approach, we identified the extracts of the interviews which refer to the struggles of the

IF. As pointed out by Voss, Tsikriktsis, and Frohlich (2002), the transcriptions of the interviews facilitated the analysis of the data, and we could build most of the tables in Chapters 4 and 5. The third and last proposition tries to bring the contribution from the integration mechanisms. To analyze the data, we also try to find in the transcribed interviews data which can validate this proposition. We assume, following the aspects discussed in Chapter 2, that integration practices (similar to integration mechanisms) mean the establishment of mechanisms to coordinate the activities within the established firm between different organizational functions, business units or the corporate level, in order to achieve the aims of the IF.

In Chapter 4, we describe all the integration mechanisms observed in each firm. In Chapter 5, we filtered them, highlighting just the integration mechanisms which refer to the struggle of the Innovation Function to borrow resources.

We observed, as detailed in Chapter 5, emerging the integrator role, such as the hunter of resources (Quim) or the orchestrator of strategic alignment (Quim). All of them refer to individuals within the IF who have or adopt the role of linking the firm's internal employees to hunt for resources or orchestrate strategic alignment. Figure 15 synthesizes the data analysis.

Figure 15 - Process of data analysis



Source: The author

## 4. Cases

This chapter is focused on analyzing each case individually. Eisenhardt (1989) emphasizes the importance of identifying the empirical evidence of all data highlighted for each case. In this chapter, all the cases are supported by the excerpts of the transcribed interviews and in some by information from the firm's financial report.

This chapter follows Eisenhardt's (1989) recommendations for conducting case studies. The chapter is based on three aspects for each case. First, the analysis tries to include an overview of the IF and the project portfolios, which also include radical innovation projects (extended definition for radical innovation). Second, the analysis aims to discover the needs in each case for the IF to borrow resources. The data from the empirical research reveal different needs, which are relevant to answer the research question of this dissertation. The third aspect describes the integration practices for the Innovation Function to borrow resources.

### 4.1. Case 1 – Quim

#### 4.1.1. General Information about the firm and its Innovation Function Chart and Project Portfolios

Quim is a Brazilian multinational chemical firm, with R&D centers in Brazil, USA and Europe, has more than 30 plants in different countries such as Brazil, Germany and USA. It leads world market of plastics from renewable sources and the Americas thermoplastic market. In 2008 Quim, following an ambidextrous organizational approach, created a separate organizational structure to stimulate the systematic and continuous development of radical innovation projects. The mandate of the IF at Quim includes sensing new opportunities, external funding, negotiating with internal business units for funding radical projects, managing external partnerships, and the prospection for external funding. At Quim, the IF aims to search and deliver new business opportunities to transform the firm from a traditional petrochemical to a green chemical company.

In 2016, the IF managed a portfolio of around 25 radical projects in the discovery phase, all linked to new businesses opportunities that go beyond the current business



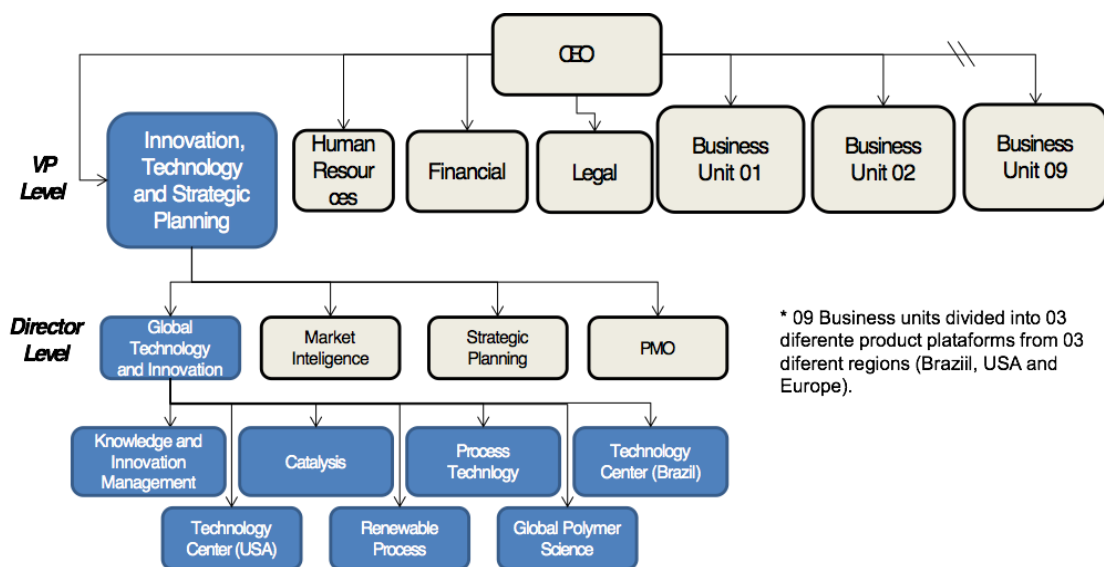
units' R&D, marketing and engineering focus. It was evidence of the firm's strategic intentions to further its core business.

As noted by Salerno and Gomes (2018), Quim, like many other industries in Brazil, operates in commoditized markets and was created with technology licensed from abroad. Its growth was limited by technology contracts, which prevented access to certain captive markets of the technology owners. Quim seeks to innovate by developing more environmentally acceptable processes and products, mainly via renewable raw materials.

The IF at Quim employs around 100 permanent employees linked to the Vice President (VP) of Corporate Technology and Innovation (see the following organizational chart). This VP is directly linked to the CEO, the organizational functions of financing and human Resources, and the firm's business units. Under the Innovation VP there are directors of innovation and global technology, market intelligence, strategic planning, and PMO. Below the director of innovation and global technology (third level of the following figure) are technical team managers (process technology, catalysis, polymers) and the innovation and knowledge manager.

Figure 16 shows an overview of the organizational chart. The elements highlighted in blue refer to the IF and include the managerial attributions such as knowledge and innovation management and Research and Development laboratories (e.g., catalysis) and technological centers in different countries.

**Figure 16 - Overview of the organizational chart at the Quim**



Source: The author

The activities of the IF go from the first laboratory experiments to the initial tests in pilot plants, especially covering discovery and incubation activities. Currently, the IF manages three different innovation project portfolios: core, adjacent and transformational. The innovation managers informs that:

*“Today the core portfolio includes the innovations that are within my domain (core) of knowledge whether they are in the technological or marketing areas. The **Adjacent** projects are those that require a technology or market that I do not dominate. The **Transformational** projects involve very new unknown aspects, for instance, a market and technology that I do not know.”*

Transformational projects refer to the development of processes to deliver chemicals from renewable sources. Adjacent ones include the really new innovation projects and core innovation projects are considered incremental innovation projects. According to the extended definition of radical innovation, the adjacent and transformational innovation project portfolios will be regarded as radical ones.

#### **4.1.2. Why does the Innovation Function at Quim need to borrow resources?**

Quim allocates resources for innovation projects according to the Business Unit’s decision. In terms of financial resources, there is a strategic orientation to every year initially allocate 0.3% of the gross corporate operating revenue to innovation projects. This amount is assigned to all current innovation project portfolios: core, adjacent and transformational. This percentage of the gross operating revenue must include capital expenditure (CAPEX) and operational expenditure (OPEX). The former includes finance for buying equipment, building laboratories or pilot plants. In other words, financial resources for the acquisition of assets that will have a useful life beyond the tax year. The latter, OPEX, is related to the ongoing costs for running the IF team, such as wages and general and administrative expenses.

However, the IF has no financial autonomy to invest in the innovation project portfolios. The annual budget for innovation projects, including OPEX and CAPEX<sup>19</sup>

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<sup>19</sup> Capex, or capital expenditure, is a business expense incurred to create future benefits (i.e., acquisition of assets that will have a useful life beyond the tax year). It includes, but is not limited to, pilot plant or laboratory infrastructure. Opex, Operational expenditure, is the cost for a firm to run its business operations on a daily basis. It includes the salaries of the researchers and the current expenses related to the development of the innovation projects.

investments, is defined according to BU's interests. As the innovation managers informed:

*“The demand comes from the business unit. For example, there is a particular demand from the business unit, and we need to know, for example, how it makes polyethylene with a certain type of catalyst. Then the innovation area comes in with the catalysis competence, for example. It is the catalysis area that will study how to do this. So the catalysis area studied it, produced a feasible alternative and returns to the business unit with a reply. Because the business area will pay the bill, the business unit will receive the returns. It receives a new product, or an improvement in the product, or a new process, or a new technology that will benefit the customers of the business unit.”*

The innovation projects are funded by the Business Units, which are the "end-areas", i.e., those that produce and commercialize final products and generate cash. There are nine business units divided into three different product platforms into three different regions, Brazil, USA and Europe. The resource allocation for innovation projects varies according to the business unit plans, as pointed out by the innovation coordinator.

*“If 60% of the innovation effort [a proxy related to the resources allocated to OPEX and CAPEX for the projects of any of the three portfolios managed by the IF] is for the polyolefin unit (a certain business unit) then they will pay 60%. If 10% of the effort is from the other business unit, then they pay 10%. Each unit pays in proportion to the effort it makes... They (the business unit) pay everybody's salary here and the other expenses, even the coffee we are drinking here.”*

At Quim there are two logics for the IF to borrow resources for radical innovation projects: i) a proactive approach of the IF to sell the projects to the current business unit; ii) the corporate level (C-level) approach to request funding from the current business unit for specific projects, which the BUs might not be interested in initially, and the corporate level instructs the BU to lend resources to the IF.

**The first logic, the proactive approach of the Innovation Function, refers to the capacity of the Innovation Function to convince the business unit to lend resources for innovation projects.** The basic idea can be seen in the argument of one of the IF managers.

*“Every year we look at the set of things we want to do, and we prepare the budget, and we align with each BU director the resources that we're going to need. This generates a financial value, and the guys (those responsible at the BUs) pay us”.*

As explained by him, the buying of the innovation project portfolio occurs as follows:

*“We (the IF team) present our pipeline of projects to business leaders, and they will define the support. They will say, for example, ‘This year, I won’t need so much from the innovation area, so I’ll put, say 10%, in your pipe’. Another business unit might say, ‘This year, I’m going to use a lot of innovation so I’m going to pay, for example, 30%.”*

In the first approach, the IF has limitations to search for new business opportunities far from the business unit intentions. The business unit intentions circumscribe the IF capacity to convince. The BUs act as the “buyers” of innovation projects of the IF, which has a hard task to persuade the BUs to lend technical workforce, laboratories, and financial resources for radical innovation projects. It is an attempt to borrow, especially, Capex resources for the adjacent and transformational project portfolios, at least in the projects initial phases.

Besides, as pointed out by one IF manager, many CAPEX resources may already exist in the parent firm, and it does not make sense to duplicate them. Furthermore, most radical innovation projects require resources, which can only be used a few times. As he said:

*“Most often, I do not start from scratch [carrying out a project that will depend on the acquisition of resource]. Because I can make use of the resources that already exist. For example, I already have two nuclear magnetic resonance machines. I’m not going to buy a third one. I borrow it. Another situation, I have seven pilot plants in operation, so I try to make use of them.”*

During the development of a new polymer, this situation was observed. The project started in August 2014. Quim had produced the new polymer, i.e. it has made Capex investments to build the plant. From the Opex perspective, this project has consumed internal IF resources. During the committee meetings for project proposal assessment, this project would not be approved. As pointed out by the IF innovation manager, however, the decision changed, because the decision makers considered that:

*“We did not have to buy new equipment. We do not need to spend to make a pilot plant. Because we already have it. The investment would only be OPEX, just the human resources of our team to adapt the required technical specifications, such as rigidity and durability. We change the additives, for example. We had had the polymer technology<sup>20</sup> since 2004. It is on top of the development of a product that we already know.”*

However, as he stated, this situation characterizes a dependence on the capacity of the existence of pilot plants to support IF projects. It is not always possible to guarantee that

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<sup>20</sup> Made from renewable sources instead of oil. This dissertation occulted the name of the product to maintain the firm unidentified.

the innovation project portfolios will be prioritized in this situation. This can be possible when the pilot plants are being underused, and the innovation team is able to convince the BU director to use them provisionally.

Before 2016, as pointed out by the innovation manager, the IF had projects that did not fit into the BU intentions. Quim had an internal business unit with financial resources to fund radical innovation projects. As stated by the innovation manager, “*during this time we did not have to ask the “blessing” from the business units*”. After the first half of 2016, the Quim strategy focused on generating more immediate returns (short-term returns). As a consequence, Quim restricted investments and introduced a reward system focused on rewarding the IF team for achieving project goals during the short-term period (e.g., the current year). An initial conclusion is that, as noted by one innovation coordinator:

*“For example, if I, at the beginning of the second semester, imagine that I will not achieve the annual portfolio goals, I am prone to prioritizing smaller and lower uncertainty projects, which I launch, for example, in two months, benefiting short-term projects.”*

In this way, at the beginning of 2017, as noted by three members of the team responsible for managing the innovation portfolios, transformational projects (the most radical projects at Quim) have been discontinued or put on “hold”. One of the immediate consequences is a higher focus on low uncertainty innovation projects (core innovation project portfolio) or at least the projects related to the adjacent portfolio (remembering that adjacent projects include our expanded definition of radical innovation). On October 11, 2017, for example, the coordinator of the management system of the IF showed the aggregate position of the current project portfolios, which contained 343 innovation projects in progress. Around 40% of the projects were related to adjacent categorization and 60% to core categorization.

Notwithstanding, since the end of 2017, Quim has tried to change the portfolio composition and the firm’s positioning as regards the radical innovation portfolio projects. Since then, Quim has boosted the higher uncertainty innovation projects in the highest hierarchical committee. Quim’s CEO and IF VP and IF managers are discussing a new composition for the innovation portfolios. Quim is structuring at least new project portfolios, comprising, for example, radical and disruptive projects; and projects focus on generating new knowledge bases or new competencies, without a tangible result

immediately incorporated in a product or production process. As a consequence, the IF since the beginning of 2018 has regained importance within Quim.

Besides, to boost radical innovation projects, some exceptions related to the second logic for the IF to borrow resources for radical innovation projects.

**The second logic is focused on the situation where corporate leadership requests the BUs to lend resources to the Innovation Function.** This situation normally occurs through the involvement of the C-level leadership. As the innovation manager explained, nowadays the CEO is taking on a more provocative role. Since, 2017 a new CEO has tried to restructure the boosting process of radical innovation projects. The previous logic of funding was impeding the development of such projects. The CEO starts arguing for a more focus on innovative project portfolios with the Quim board. As noted by the innovation manager, it is common to observe the CEO arguing with the heads of the business units to have innovative projects, for example, by asking them:

*“These portfolios are too often going toward strategic cost reduction intent, shouldn’t they be going toward a more long-term strategic intent?”*

This position boosted the development of other new polymer. The idea was based on a 20 year long technology roadmap. A committee of the CEO and VPs decided to continue the project. They discussed the idea with the BU (Polyolefins and Renewables units) that would produce it after acceleration to get their consent. A strategic partner was chosen for the development of the specific bioprocess, making a technological cooperation agreement with North American and French firms for the development of the technology for the production of isoprene from renewable sources, including chemical input used by the tire industry. Under the terms of the partnership, the three firms will work together to accelerate biochemical studies using sugars from sugarcane and cellulose inputs to develop the new isoprene.

However, as pointed out by one of the IF managers, this provocative behavior is not controlled by the IF. It can vary according to the external factors, for example, an economic crisis, which influences corporate plans. At the end of 2017, he states that,

*“Is the focus now is for us to be inventing the wheel or to make money from incremental projects? What gives me more money in the short term? We had many transformational projects. And then we were able to evolve. But as the economic crisis began to appear, the area of innovation was no longer required for transformational projects, but rather for adjacent and core projects”.*

#### 4.1.3. Integration practices for the Innovation Function to borrow resources

The IF is involved in different integration practices to borrow resources for radical innovation project portfolios (i.e., Capex assets such as laboratories, equipment, workforce and financial resources). The practices refer to: i) a monthly report panel for the responsible business units; ii) three different committee meetings to assess project proposals and define resource allocation; iii) internal idea generation campaigns to stimulate new project proposals; iv) hunting for internal or external resources; and v) the orchestration of strategic alignment as an attempt to avoid BU funding dependence, proposing a new alternative to innovation projects funding.

The first practice is a monthly report to the VP and Business Unit directors at Quim, offering a “cockpit” view of the innovation project portfolios based on an *indicator panel system*. As explained by the innovation coordinator:

*“We have a panel of indicators. We report to business leaders (business units) on a monthly basis. It is possible to have a vision of how many projects we have, what is the stage of each project and what return it can give, how many launches per year, how many projects we have in the current year, how many projects we promised we would have, how many projects were discontinued. Each business unit receives the information about the specific projects of its business. For example, BU X receives information on 127 projects that the innovation area is promising for the PP area, the value of the projects (\$ 1,591 billion), whether it is risk-weighted, going to about \$ 1 billion. The panel goes to the Innovation VP, the Innovation Director, the other VPs, all the innovation managers, plus key users of innovation projects (e.g., focal points in specific business units such as the Mexico and Germany units), or if they already have the information, to the Business and Innovation VPs and their directors.”*

The *indicator panel system* is a formal report of the IF, used as a database during different committee meetings and which is necessary for the approval at the outset of an innovation project of the allocation of resources and to make the Go / Kill decision for resources.

The committee meetings are the second practice and refer to monthly and quarterly committee meetings and the annual one (the C-Level Forum). They include different phases of the development of radical innovation projects. The phases start by idea generation, which can occur by a spontaneous action of a member of the IF team who suggests potential ideas for new projects on the corporative online system. Alternatively, the IF team promotes more direct actions such as an idea generation campaign to foster new ideas.

The ideas are then analyzed by an internal IF team, considering the qualitative criteria of market attractiveness and technological viability. This same team establishes scores for each idea and submits them to the monthly committee participants: i) business leaders (those responsible for the related Business Unit); ii) market development staff; and iii) the technology team responsible for the IF. This analysis is the primary input of the monthly committee, which is focused on the Go or no Go decision project for each Business Unit.

At Quim there is an annual committee meeting (Portfolio Day), with the presence of the highest hierarchical level, the CEO, VPs and directors).

*"This Portfolio Day involves the Quim CEO. There you see the PE and PP (two business units) leaders killing each other. There you have a vision of what Quim SA will invest in. He (CEO) is the one who gives the final endorsement. He's made all the previous alignment with the heads of the business units, but he (the CEO) is the one who takes the final decision. Portfolio Day is the time of the decision to allocate the Capex budget. The Innovation area gets a little basket from it there."*

In terms of the innovation projects, this committee assesses the balance of the three IF portfolios. Between the monthly and the annual committee, there are the quarterly committee meetings, and technological committee meetings to assess the project development, which generally include the directors of the IF and the Business Units.

As mentioned, there is also an idea generation campaign promoted by the IF team (innovation campaign). This is the third integration practice. There is no regular annual calendar. The campaigns aim to stimulate innovation project idea generation and are based on design thinking methodologies. They are an integration practice for two reasons: firstly, the campaigns involve people at Quim from different organizational areas such as market development, technical assistance, and sales outside the IF; secondly, the IF team has the mission to spread the campaign, stimulate the participation all through the firm, analyze the input of the initial ideas, and discuss the results with the leaders of the business units.

*"We have the discipline to generate events from ideation. For example, we make use of design thinking methodology. We usually bring a challenge. So this challenge may have come from the business (business unit), may have been required by client or by us here at innovation management. It has the Quim strategy, and we have seen that the pipes are very focused on the core, Nono [a member of the knowledge and innovation management team] made a study together with the entire leadership in the innovation area and saw that we have to seek more disruptive things, so then we try this via these ideation events. They*



*involve the area's innovation staff, market development staff, technical assistance, applied engineering, sales guys. We organize the event, bring the challenges, use the methodology, put together the generated ideas, rank them and see what will go into our pipe or not.”*

Furthermore, the results from these campaigns can be nurtured by another internal activity of the IF team: searching for public funding. The idea is simple. At the monthly or annual committee meetings there is a person in the IF team responsible for searching for financial public funding for the projects analyzed.

There are also the fourth and fifth integration practices, which are related to the innovation manager's activities, especially the innovation and knowledge manager, who works continuously as a hunter for project opportunities, internal alignment, and funding. These practices are denominated here as *hunting of resources* and *orchestrating of strategic alignment*.

As pointed out previously, the innovation project portfolios at Quim depend on the current business unit interests, and the IF managers have to fight for the continued funding of their project. In this battle, they will take on a role of *hunters of resources*. This role does not only focus on financial resources but also seeks to borrow infrastructure resources such as the use of an equipment for a predetermined period or the support for someone from the business unit who can help with technical assistance.

The project of the new polymer is an example of the hunting of resources by IF team members. This project aims to develop a renewable polymer to produce plastic bottles and also belongs to an adjacent portfolio. Quim does not dominate the technological aspects of this project but knows the main characteristics of the market. The project has used OPEX and CAPEX resources and followed all the committee approval meetings mentioned earlier. The outset was in March, 2016, and the launch on the market of the new product is planned for June 2024. Most of the expenditures, especially CAPEX, were directed to looking for a partner.

Following the Quim organizational logic, the business unit responsible for renewable polymers bought this project and is now responsible for the allocation of resources. However, it was necessary to find a partner with the know-how to operate an industrial plant (at the beginning, a pilot plant). The IF manager was interested in discovering information from the VPs and the CEO which can guide the IF innovation portfolio and increase the probability of funding of the innovation portfolio. The innovation manager

considers that, if he is involved in the main strategic decisions and intentions of the firm, he can (re)structure an innovation portfolio with a higher chance of funding and support from the technical team and the use of laboratories and pilot plants throughout Quim. Furthermore, the participation of the IF manager makes it possible to refine the intentions of the CEO and VPs to build a new composition of the innovation project portfolios (as pointed out early — the intention to build portfolios more adherent to radical innovation projects). Thus, the the IF manager acts as an *orchestrating of strategic alignment*. He has the opportunity to propose projects that could be funded directly at C-level. This is an attempt to avoid dependence on BUs, proposing a new logic for the funding of innovation projects.

The IF innovation and knowledge manager organizes the (re)structuring of the strategic intentions and innovation project portfolios by getting closer to the C-Level and the IF operational level. The main point is their capacity to capture information from the highest hierarchical level at Quim to gain insight to be incorporated into the innovation project proposals. They act as an informed insider, *orchestrating strategic alignment* to (re)structure the innovation project portfolios. This innovation and knowledge manager pointed out that:

*“I take part in the three committees related to the financing of innovation projects. Throughout the year we have several strategic committees dealing with various issues. I'm getting inputs from the business units. So, so I'm adjusting my portfolio, adjusting my proposal [in this case it refers to the projects of the innovation portfolios of the IF]. There is the **regional committee** (the same business in one region, for example, PP Brazil), **the global committee** (same business, however in different regions, PP Brazil + PP USA + PP Europe), and that of the **CEO, VPs** (highest level). Recently (since the end of 2017), the CEO and VPS committee has met four times a year, the global as well, the regional six to eight times a year.”*

This is the reason why the *orchestrator of strategic alignment* tries to take part in all the committee meetings. Furthermore, since the end of 2017, the C-Level of Quim has attempted to change the portfolio composition and the firm's positioning as regards the radical innovation portfolio projects. They want to boost the higher uncertainty innovation projects in the highest hierarchical committee. Quim's CEO and IF VP and IF managers are discussing a new composition for the innovation portfolios.

Table 16 provides an overview of the different integration practices observed at Quim.

**Table 16 - Integration practices at Quim**

| <b>Practices</b>                              | <b>Frequency</b>                | <b>Responsible</b>  | <b>Benefits</b>   |
|---|---------------------------------|---|---|
| <b>Report: indicator panel system</b>         | Monthly                         | IF team responsible for the IT system to manage IF project portfolios     | Offers an overview of the evolution of the projects, the financial resources allocation, the financial return expected and the achievement of the goals.<br><br>Monitors radical innovation projects evolution.           |
| <b>Committee meetings</b>                     | Monthly, quarterly and annually | Monthly: technology leadership<br>Quarterly: Directors<br>Annually: IF VP | IF team<br><br>IF<br><br>Permits the continuous alignment between different organizational levels.<br><br>Establishes decision rules (e.g., criteria and committees) to borrow resources for radical innovation projects. |
| <b>Innovation campaign</b>                    | On demand                       | IF team responsible for idea generation and searching for public funding  | Amplifies idea generation throughout the firm.  |
| <b>Hunting of resources</b>                   | Continuously                    | IF knowledge and Innovation manager and/or their team                     | Obtain internal or external resources to nurture the innovation project portfolios.   |
| <b>Orchestrating of strategic information</b> | Continuously                    | IF knowledge and Innovation manager                                       | Try to reformulate IF resource allocation dependence on BU.   |

Source: The Author

Table 17 summarizes the different IF borrowing resources context, the consequences and the IF team efforts, according to the firm, portfolio and project perspectives.

**Table 17 - Summary of the Innovation Function borrowing resource context at Quim**

| <b>Perspectives</b> | <b>Borrowing resources context</b>   | <b>Consequences</b>  | <b>If efforts</b>   |
|---------------------|--|--|---|
| <b>Firm</b>         | Current firm's strategy is focused on generating more immediate returns (short-term interest of the four). | Innovation portfolios are focused on BU's interests or dependent on C-level requests to BUs. | Orchestrating to influence Quim's strategy to avoid funding dependence on BUs.  |
| <b>Portfolio</b>    | IF needs to sell the projects of the portfolios to the BUs.  |  | Hunting to reformulate different innovation project portfolios, not dependent on BU's interests.                        |
| <b>Project</b>      | IF has own limited financial capacity to invest in the innovation projects.                                | High uncertainty project (as transformational) are rare.                                     | Hunting for resources for innovation projects (e.g., hunting for underutilized Capex assets in different pilot plants). |

Source: The author

## 4.2. Case 2 – CompAuto

### 4.2.1. General Information about the firm and its Innovation Function Chart and Project Portfolios

CompAuto is a leading global system supplier for the automotive and engine industry, with a total of 75,000 employees around the world and 13 major research and development centers in different countries such as Germany, UK, USA, Brazil, China, and India, employing 5,000 engineers and technicians. The Innovation Function is part of the firm's strategy to focus on innovative long-term projects and forego short term results such as cost reduction and imitation of competitors. As the Global manager of new business platforms reports.

*“We closed several projects whose intention was to match what the competitors already were doing or had. This takes into account a time horizon of the last 10 to 15 years. Similar idea to "me too". Now we are more along the line of seeking better concepts. Otherwise, our fight will always be for costs.”*

There are four Business Units (BUs) at CompAuto: Engine Systems and Components, Filtration and Engine Peripherals, Thermal Management, and Aftermarket.

As noted by the interviewees, CompAuto needs to go beyond the current product market knowledge domains. The firm has an explicit strategic intention to emphasize a future-looking, longer-term perspective. Consequently, the necessity to explore new business opportunities and new knowledge emerges, and this is the main reason to create a new product portfolio. It is summed up by the Global manager of new business platforms.

*“There are forces to take the internal combustion engine out of the world market in the coming years. This makes the company realize that it needs to diversify its portfolio a bit more. There is a lot of uncertainty about our business in the long run. Therefore, the company allows the separation of a greater volume of resources for projects with a greater risk.”*

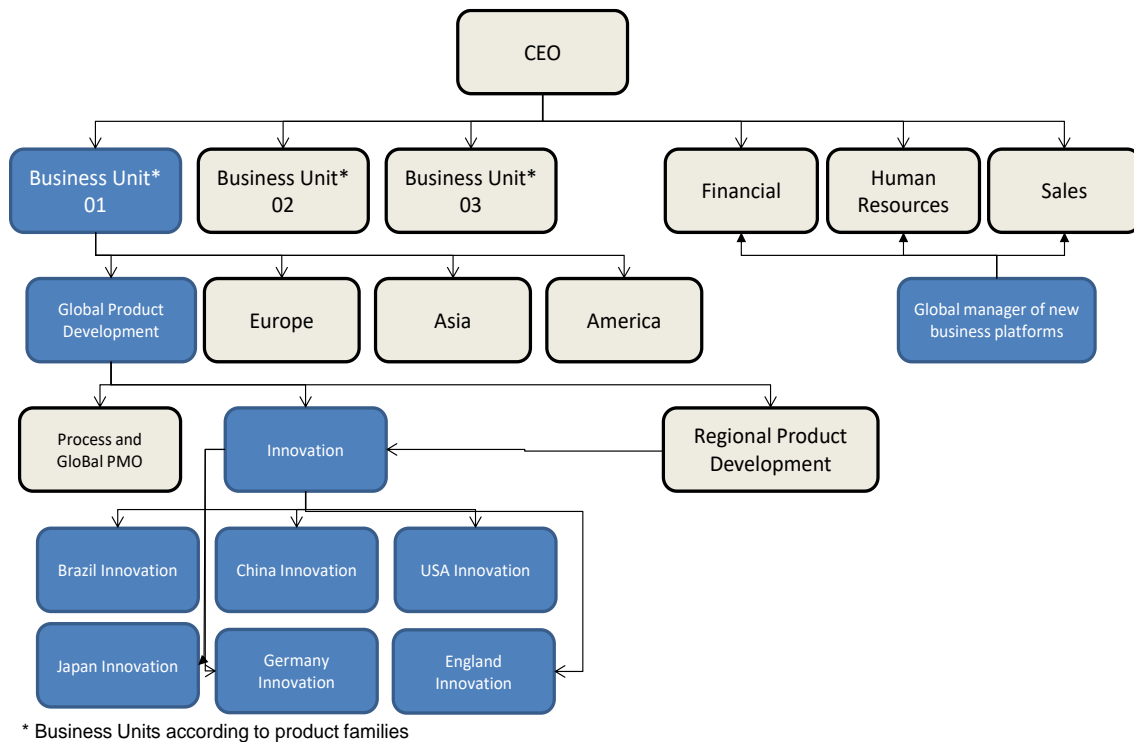
Considering this assumption, a natural first question is to understand where or on which markets CompAuto is trying to focus. A consequence of this intention of CompAuto is the existence of innumerable market alternatives to expand its boundaries. However, as all interviewees pointed out, CompAuto has had difficulty to define and estimate the resources to allocate to the innovation projects to achieve this expansion.

*“There are projects where the confidence in the business case that we are formatting is greater, so we can untangle the working package necessary to build a business case, but there are other projects in which the main difficulty has been to know what the next step is. For example, we have questions about how to know a little more about what are the technical complexities. Then how can I get a market perspective? Who would be the main customers? Is it the same chain of customers? Things like that. And obviously the more distant from the automotive sector, the harder it is for us.”*

The IF is responsible for managing the new product portfolio and the technological incubation portfolios. Each BU has one technological incubation portfolio, and there is just one new product portfolio, which is global, and this has a considerable range of diversity of technologies not related to the current business of CompAuto, based on radical innovation projects. The new product portfolio refers to the *stricto sensu* definition of radical innovation as described by O'Connor et al. (2008). Here it relates to new business platforms, which aims to change the firm's growth, based on radical innovation projects. The technological incubation portfolios are related to the definition of really new innovation, with low market uncertainty but high technology uncertainties and address the known market of CompAuto but with an unknown technology process.

IF has an innovation manager for each BU and also a Global manager of new business platform, who manages the new product portfolio. The following chart highlights the IF at CompAuto. The technological incubation portfolios have one coordinator for each business unit. For example, for the business unit, engines system and components, the manager of the technological incubation portfolio is represented in the following figure by Brazil Innovation (the last level of the following chart). During the data collection period at CompAuto, the Global manager of new business platforms took on a double position, also being the innovation manager of the business units of engine systems and components, represented as “Innovation” in the following figure (“penultimate level”). However, he is also the Global manager of new business platform and in this position reports directly to the directorship level, as seen on the right of the Figure 17. The chart in Figure 17 highlights the IF in the blue boxes.

**Figure 17 – Overview of the organizational chart at CompAuto**



Source: The author

As explained by the Global manager of new business platforms, the new product portfolio handles the discovery and incubation of new business prospection:

*“We deal with projects outside our main product families, our main areas of activity. So it's not a new piston, a new connecting rod, a new ring, a new drive shaft. We then try to incubate new business possibilities. So it is more than just the development of a new product. It is also the identification of how this product should be traded on the market, how it should be manufactured, and therefore, we will evaluate a business case (...) The main competence must be in CompAuto, and we can acquire new competencies from other firms, bring in people, or create groups to develop a new product.”*

The new product portfolio is based on discovering new business opportunities, based on new market exploration projects. This portfolio deals with business environments adjacent to the firm’s core (components for automotive combustion engines), such as new energy generation sources and lubricants.

This portfolio must be aligned with the firm's technology competencies and include projects to acquire new competencies from other companies, bringing in external collaborators or creating interfirm groups to develop an exploratory project. This portfolio targets the generation of three business cases.

*“The idea is to discover opportunities that our installed capacity can handle, but which do not exist with our current products. Well, we know that the demand for combustion engines is going to disappear”.*

Considering the new product portfolio, IF has developed business cases, fundraising approaches (internal or external to CompAuto) and managed technology development (initial tests, improvements, new tests in labs) and trials with potential clients. In the first quarter of 2018, the new product portfolio had three new globally ongoing projects.

On the other hand, the technology incubation portfolios refer to new concept development and concept validation of a new product that already belongs to the core business units. The technological incubation portfolios are focused on technology incubation projects related to new combustion engines, new materials, new coupling of materials, and new geometries. For example, the technological incubation portfolio of the Engine System and Components Business Units had seven projects, considering just the incubation portfolio of piston rings (one of the products of this business unit).

As explained by the manager of the technology incubation of products related to engine system and components:

*“Our technologies, for example, need to be turned into products to be offered in the NONO 1.6 2020 engine and the like. If I develop a new, more wear resistant coating of piston rings, which may require a new coating process, then I need the design to first go through the technological incubation. The incubation portfolio serves to mature the concept before it tries to generate business. The focus is on capturing the technical potential and clarifying doubts about the technical viability of the new idea (concept). Deliverables are more flexible. I can do more recycles. For example, let's say I want to develop new material with 17% chrome. So I realize it was a lot, it has a lot of chrome. So, I do some recycling and try to validate the concept with 15% chrome, for example. These designs may have some recycling inside some deliverables. The other characteristic is that in this portfolio we evaluate the feasibility, mainly technical feasibility, of manufacturing, with a very preliminary cost analysis. (...) The technological incubation projects are those whose technology we still do not have much certainty. Projects are born and usually die. I'll start by analyzing a body of evidence, and I can make an initial analysis, etc... These are shorter projects, usually six months. We do not invest so much. We only have two gates. Concept Develop and Concept Validation.”*



#### 4.2.2. Why does the Innovation Function at CompAuto need to borrow resources?

The reasoning of the budget allocation of the two IF portfolios, which are defined annually, is based on different arguments. As for the technological incubation portfolio:

*"The definition is prior and carried out globally by the board. Based on the importance that the product has and the perspective of future income growth, it will receive a slightly higher percentage. So the percentage going to each of the portfolios is different. The directorship decide."*

On the other hand, the budget allocation to the new product portfolio is related to a predefinition according to the demand presented by the person responsible. The finance allocated to this latter portfolio is lower than the resources to the technology incubation portfolio. As noted by the Global manager of new business platforms:

*"When I develop a new piston, or a new ring, we are talking about amounts that can easily reach 500 to 700 thousand euros. The idea is that we can make a business case analysis, spending something like 20,000 to 30,000 euros so that we are able to analyze what is the volume of resources needed. Also what is the level of complexity, what is the environment of competitiveness that a new product brings, so that CompAuto is motivated or not to move forward, investing the 500 to 700 thousand euros for its later development and the necessary finance for manufacturing that will come later."*

In both situation, IF needs to borrow additional resources, mainly human resources internally from different business units or to perform laboratory tests. The managers need to negotiate with the business unit or laboratory responsables, and as a counterpart these costs are allocated to the IF "cost center". And, in a more mature phase of the project – mainly in Acceleration - in O'Connor et al. (2008) terms -, often there is the need for capital expenditures (Capex), that is, investments in scaling up or production physical capacity.

All the interviewees pointed out that every year these definitions are an estimate with a low probability of attending the needs of the innovation project portfolios. Therefore, some alternatives regularly appear. The IF portfolio managers can reallocate resources internally to test a new opportunity, or, if necessary, the portfolio manager can ask the C-level for additional investments. Furthermore, the managers have the flexibility to use the resources of their portfolio. As noted by the technology incubation portfolio manager in Brazil, "for incubation technology I can spend here in the region as I wish".

However, there is no guarantee of the independence of the IF resources. As noted by the IF portfolio managers, at least one crucial aspect emerges. The need to borrow complementary human and infrastructure (e.g., laboratories) resources throughout CompAuto is important. As the Global manager for the new product portfolio states about the team responsible for the development of the projects from this portfolio:

*“One of the main conflicts is that of resources. We are talking about the engineering group, which has a finite number of people. It is not an environment that is simple to compensate for with outsourcing. So often an innovation portfolio tends to compete for resources that are common in other portfolios. Sometimes you have to wait for laboratories disponibilities, whether in the engine lab or in other labs.”*

However, is not a simple task for the manager of a new product portfolio to define which human resources will be necessary. In most cases, human resources are necessary for specific tasks of the projects and returns at the end of the tasks. He notes that it is very common to need technical engineers from different Business Units, but he cannot foresee this necessity when defining the budget in the previous year. Then he needs to establish some internal links to borrow human resources. He explains that there are some stages for this articulation to happen. He tries to negotiate an interregional cooperation activity to borrow engineers from the business unit, and this negotiation can involve just the innovation management of different countries or can demand the involvement the director of the business unit, or the C-Level.

As a consequence, the IF has to overcome internal resistance to borrow resources for radical innovation projects. It is typical for the global manager of new business platforms and/or the technical manager of projects to take a defensive attitude to avoid the reduction of the costs of the project. As will be discussed below, there is a project required by the automakers' value chain firms, headed by CompAuto, and the Massachusetts Institute of Technology (MIT). The project is 16 years old and it is still ongoing. This project is a typical discovery phase of DNA Model. It starts exploring new knowledge, which can leverage further projects to be incubated. The CompAuto interest was to boost the understanding of engine lubrication to design more reliable engines with lower fuel consumption.

The MIT research team is the technical area responsible for the project. Furthermore, firms are free to articulate the development of co-joint projects. For example, in order to maintain the allocation of resources, especially financing, of this

project, the global manager of new business platforms at CompAuto reports that he now needs to take a defensive position. As indicated, the projects have no clear and pre-defined deliverables and gates, a traditional point to decide whether resources will continue to be allocated or not.

*“It is not easy to understand the deliverables in a longer-term project portfolio. In a long-term project like this one here that does not have a date to finish. As long as you have energy and interested companies it continues. Inside the company, management is more complicated because it does not have a gate. What it does have is a reporting of which are the outputs and an alignment of CompAuto's vision of prioritization for the next review.”*

#### **4.2.3. Integration practices for Innovation Function to borrow resources**

In order to borrow resources, The IF function is involved in three integration practices. One practice is related to establishing the assessment process to approve the innovation projects — *committee meetings*. The second refers to the *follow-up meetings to defend the projects*. The third is denominated here as *hunting external support* for the projects. The three practices are discussed below.

The committee meetings are regular and formal meetings for resources allocation decisions. The basic idea is to establish rules to assess innovation projects and define the resources allocation to the innovation projects. These meetings follow a pre-defined and formal sequence. As in most established firms, the projects begin as a generation of the project proposal (in an ideal generation). The proposal can be random (spontaneous) or fostered from internal campaigns. CompAuto has various sorts of demands or challenges, generally fed by a product roadmap review of every product, and supplemented by an internal campaign to collect ideas through the internal IT system.

As pointed out by the incubation technology manager,

*“Every year there is a review of the roadmaps of each product. From March to May each region will review the demand for products from its region. Here we will do the regional rings, regional sleeves, regional pistons, and then we gather the engineering, applications, and sales staff. For each demand, I get to know which projects I have today and which ones I need to open. This review is carried out once a year by the management group responsible for each product.”*

For the first analysis, each project proposal is directed to an internal referee, who will give feedback to the authors. These paths are the most common to feed the

technological incubation portfolio. As explained by the Global manager of new business platforms:

*“When ideas are evaluated by the expert, he or she will recommend whether or not you approve it or need more information. We take these ideas to a regional committee and then to a global one according to product (it meets every two months: experts from different countries, process leaders, innovation coordinators, incubator coordinators, product design coordinators, and those who can receive the ideas that may become projects and, less frequently, the product director). We bring people together with more knowledge about the product and the production process. It is the committee who approves whether or not an idea becomes a project”*

There is a regional committee, including only the home country experts, and then there is a global committee, including CompAuto experts from different countries. The first committee acts to give a “pre-approval” of the project, but requires the global committee for the final approval and allocation of resources (financing, workforce). The aim is simple: to connect assessment and opinions from the different development centers and, in case the final judgment is positive, deliberate about how to start the development of the project.

*“Each region has an incubation meeting. Before taking it to a global meeting, we will hold regional meetings (e.g., staff that will take care of Rings projects and staff from here in Brazil) to validate whether the projects are mature or not. All product managers bring regional recommendations to the committee meeting. It is common when deciding, for example, about a new project, to hear the following question: What was the recommendation of the people in Brazil? Sometimes we say the idea is interesting, but we do not have the resources to develop it here, but it would be worth developing in another country.”*

However, the new product portfolio requires a different approach to conduct the assessment process of the new ideas, project approval, allocation of resources and project follow-up. As explained by the Global manager of new business platforms:

*“When I have an idea for something that has nothing to do with my product families, I do not even have a specialist to give the first opinion. So the decision format that we go through is: idea — opinion — committee, and it gets more difficult in an environment of such high uncertainties, where we evaluate a possible product with which we do not have so much familiarity. In this case, we are having great difficulty to understand the best way to do this. We ended up choosing a group of engineers and executives to follow these projects. It is a more individual assessment, and less following a process for many projects.”*

### Follow-up meetings to defend the innovation projects

At CompAuto there are two different integration practices to protect the projects from internal forces which hamper the allocation of resources to the innovation projects.

The first is an organizational level defending the project approach. Some innovation projects from the technological incubation portfolio are protected from the internal resources disputes, especially projects linked to technology development with universities and scientific institutions. As the manager of the innovation portfolio responsible informs:

*“These projects are treated differently. We deal with them separately within the portfolio. There is a closer follow-up between the project manager and the institution. They follow the evolution of the project, and we hold a managerial meeting every three or four months to align the progress of the project and the leader of the project at the institution with the regional director, and the material, technology, and product area managers.”*

Furthermore, there is also an individual level defending the project approach. In non-regular situations, the Global manager of new business platforms and/or the technical manager of projects needs to take a defensive position to avoid a reduction in the costs of the project. In this case, there are no formal committee meetings. This position occurred during the project follow-up meetings, where the innovation managed needed to implement a defensive networking involving the technical head of the project, who was allocated by a business unit in Germany, technical supporters in Brazil, and sponsors from the board of directors. Furthermore, they need to recover to the preliminary achieved results of the project to guarantee the allocation of the human and financial resources.

*“This project, for example, has been the subject of discussions, suggesting that it should have been interrupted by CompAuto several times. Therefore, I have to demonstrate this kind of discussion: we would not have some successful products as we do now, If we didn't have this type of project... Ah so this is cool.”*

He can use his internal resources to borrow engineers or ask for additional resources from the CompAuto board. As the Global manager of new business platforms describes:

*“We came across an innovation that had a very interesting potential for CompAuto, but that did not fit into any business unit. As a result, we took it to the R&D director in Brazil, who was interested in the project. He made the decision to interface with the CompAuto board in Brazil to release extra resources for this specific exploration. For the approval of extra budgets. An important sponsor was necessary to explore an extra concept outside the business units.”*

### Hunting external support

As noted earlier, it is not a simple task for the manager of a new product portfolio to define which human, financial and infrastructure resources are necessary. At CompAuto this aspect boosts external integration approaches. Furthermore, as some radical innovation projects require specific competencies and knowledge spread out among different CompAuto R&D centers, and, in some cases, outside its boundaries, the manager of IF innovation portfolios plays an important role in helping to build the network needed to find external funding partners.

For example, CompAuto uses its partnerships with universities for specific technology incubation projects. When CompAuto does not know whether a concept will be successful, and the project requires the use of a piece of equipment or specific know-how that they do not have or have not dominated, they will ask for an external partnership to deal with this support.

*“We have partnerships, in some cases with universities, equipment suppliers, but they are usually for projects with greater risks. Because we will not even acquire a piece of equipment when I do not know whether the concept will work. I make the concept development together with the external partner. If it is feasible, if you have an interesting customer, then you make an investment plan to deliver the product to the customer. The idea is to share with partners the steps we have not mastered so well.”*

To orchestrate the search for the external partnership, CompAuto implemented the “*funding committee*”, especially for the projects related to technological incubation portfolios, and which includes the search for public funding for the project and/or for a new partnership to provide a specific infrastructure or human resources for the projects. As the manager of the portfolio in the engine system and components business unit told us:

*“The people in the innovation area have the funding committee. There is the regional director, the materials manager, the technology manager, and the innovation staff. We hold periodic meetings to see if there is any demand that a partner can solve. Then we go after it.”*

The funding committee has supported at least two CompAuto projects. The first project was the development of a cast alloy for the firm’s core product. In order to reduce dependence on external suppliers, the firm considered acquiring knowledge and competencies on how to merge steel. Considering its external successful partnerships

with scientific institutions and universities, a Brazilian technology research institute was chosen. The technology institute team has a successful history of bringing out new exciting ideas throughout their interaction. The institute had expertise in foundry techniques and could even do pilot-scale testing.

The second project is the development of new equipment for metallographic analysis to cover one of the leading products of the firm. The firm aimed to have access to research, which it was not able to do with its infrastructure and knowledge. In order to do this, a university laboratory and an academic spin-off were involved in the development stages. The project was also funded by a public agency.

*“We did not have the necessary equipment here in Brazil. So we have a project with the support of BNDES, via Funtec. CompAuto funded 10% of the budget and BNDES with the rest. About R\$ 3 million. This will allow us to have access to analyses that we do not have here today, we can use this equipment in some other coating that we want to produce. The project had two stages. The first was the construction of a piece of equipment that made certain depositions (coatings) of the material, which was made by the incubated company. After this equipment was ready (second stage), it was installed in the university, and now they are producing some samples to see if we can find some concept that has the characteristics that we need. It is a large, time-consuming project involving two external partners and supported by the BNDES. If we had to do it alone, we wouldn't do it.”*

Table 18 provides an overview of the three integration practices observed at CompAuto.

Table 18 - Integration practices at CompAuto

| <b>Practices</b>          | <b>Frequency</b> | <b>Responsible</b>                                     | <b>Benefits</b>  |
|---------------------------|------------------|--|--|
| <b>Committee meetings</b> | Bimonthly        | The manager of the technological incubation portfolios | Offer an overview of the evolution of the projects and the financial and human resources allocation and the use of the infrastructure. |

|   |              |  |   |
|---|--------------|--|---|
| <b>Follow-up meetings: defending special projects</b> | On demand    | The leader of the projects and the manager of technological incubation portfolios and new product portfolio. | Protect special projects which do not fit in with the committee meetings assessment approach. |
| <b>Hunting external support</b>                       | Continuously | The leader of the projects and the manager of technological incubation portfolios and new product portfolio. | Supports hunting for technological partners and external funding.                             |

Source: The author

The table 19 summarizes the different IF borrowings of the resources context, the consequences, and the IF team efforts.

**Table 19 - Summary of the Innovation Function borrowing resource context at CompAuto**

| <b>Perspectives</b> | <b>Borrowing resources context</b>   | <b>Consequences</b>  | <b>IF efforts</b>   |
|---------------------|--|--|---|
| <b>Firm</b>         | CompAuto prospects opportunities beyond the current business.  | Different portfolios built:<br>-New product portfolio and Technological incubation portfolio | Establishment of the IF global manager (new product portfolio) and manager according to each BU (technological incubation portfolio)  |
| <b>Portfolio</b>    | Annual predefinition of the resources for new product portfolio and technological incubation portfolios. | Limited financial resources pre-defined annually   | Establishment of internal articulation to borrow additional resources (human, infrastructure and financial)<br><br>Hunting for technological partners and external funding. |



|                |   |                               |  |
|----------------|---|-------------------------------|--|
| <b>Project</b> | Internal forces to hamper the resource allocation of the radical innovation projects. | Necessity to protect projects | Occurrence of project defenders within IF team |
|----------------|---|-------------------------------|--|

Source: The author

### **4.3. Case 3 – Pharm**

#### **4.3.1. General Information about the firm and its Innovation Function Chart and Project Portfolios**

Pharm is a Brazilian pharmaceutical firm which has four manufacturing sites in Brazil, employing around 5000 people and one technological center. Its current products developing generic drugs covering 25 specialties in dermatological nutraceuticals, probiotics and biotechnology segments. Pharm has five major Business Units: Prescription Drugs, OTC (Over-the-counter drugs), Generics, Dermatologics, and Institutional & Specialty Cares. As regular in Pharmaceutical industrial, Pharm has partnerships with scientific technological institutes and private firms to discover new biological targets or develop new pharmaceutical assets.

As pointed out by the Director of the IF at Pharm, the firm has aimed to develop radical innovation projects for over ten years. In 2014, Pharm created a Radical Innovation Nucleus. In this case, radical innovation means developing a new pharmaceutical asset. The IF concentrates the projects related to the discovery of new pharmaceutical assets in the synthetics, phytomedicine (herbal), biological and dermocosmetic categories and includes research activities focused on phases one and two of the drug development process: i.e., the discovery and pre-clinical phases, which include new insights into a disease process that allow researchers to design a product to stop or reverse the effects of the disease, tests of molecular compounds to find possible beneficial effects against any of a large number of diseases, new pharmaceutical assets, such as those that provide new ways to target medical products<sup>21</sup>.

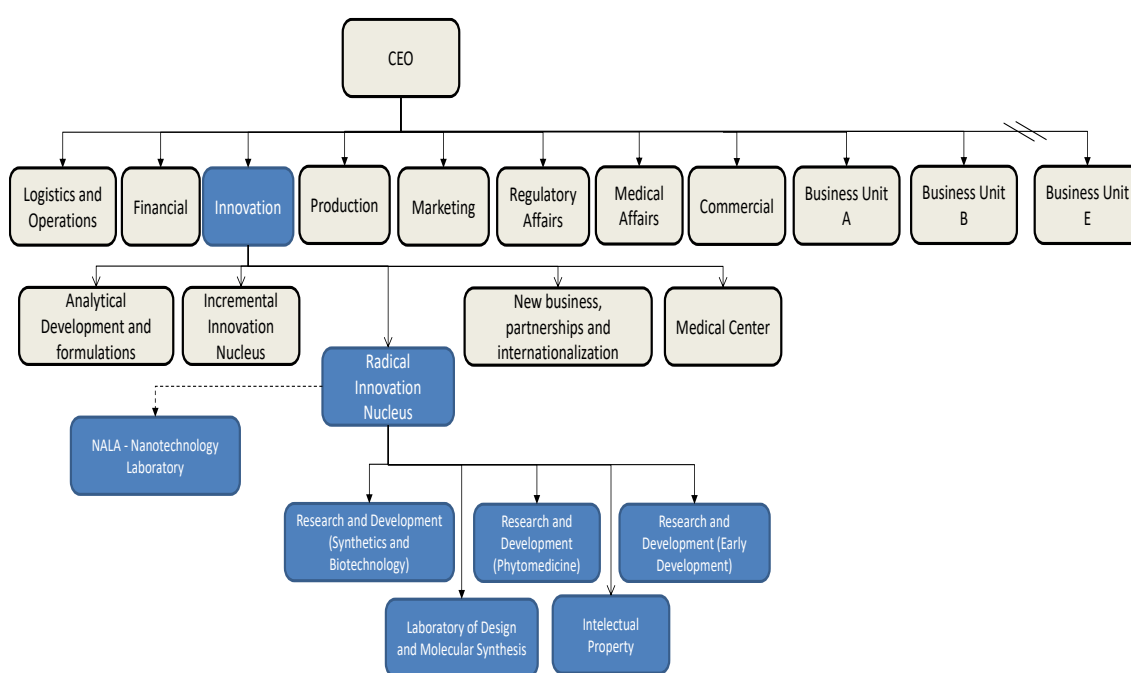
The innovation project portfolios of the IF are concentrated in the Radical Innovation Nucleus. There are two portfolios dealing with the discovery of new pharmaceutical assets, one focused on synthetic innovation projects and the other on phytomedicine, which requires different technological competencies to develop the “R” side of the R&D activities. During 2017, they were responsible for 21 projects. Each one has a person responsible for the management activities of the discovery such as the

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<sup>21</sup> For more details of the different phases of the drug development process, see <https://www.fda.gov/ForPatients/Approvals/Drugs/default.htm>

follow-up of the evolution of the projects, technical support for the team responsible for project development, internal or external funding, and running the internal committee for the allocation of resources. The IF is also responsible for discovering new technological platforms based on nanotechnology. It has 15 employees and is divided into five coordinators (Phytomedicine, Synthetics, Molecular Synthesis, Early Development and Patents). It includes different research and development laboratories, as seen in the following figure, which offers an overview of the IF, considering the organizational chart perspective. The IF is highlighted in blue in Figure 18.

**Figure 18 - Overview of the organizational chart at Pharm**



Source: The Author

#### 4.3.2. Why does the Innovation Function in Pharm need to borrow resources?

The Pharm IF internally receives CAPEX resources for laboratories and OPEX and human resources for its projects development and laboratory activities, and an allocation of the corporate resources, is defined by the C-level and the Pharm directors. This funding is mainly focused on the discovery of molecules, based on predefined medical targets. As seen in the organizational chart (figure 18), there are the laboratories within the IF: the Synthetics and Biotechnology laboratory, the Phytomedicine laboratory, and the

Laboratory of Design and Molecular Synthesis. According to the Pharm 2017 financial report, investment in property, plant, and equipment added up R\$ 90.9 million<sup>22</sup>.

The Laboratory of Design and Molecular Synthesis, for instance, started its activities in 2015 and focuses on developing pharmaceutical assets to known market needs not yet solved in different areas, such as gastroenterology, the central nervous system, cardiometabolics, respiratory health, musculoskeletal pain, and dermatology. The projects of this laboratory try to reach a technical milestone, which might bring a substantial improvement in the current products. These projects are related to really new innovation definition, understood here also as radical innovation.

As noted by the manager of this laboratory,

*“A project has a milestone of one year that has cycles of design and synthesis and biological testing. One of my milestones is to reach a target within a year with an activity of a protein isolated from nanomolar X, because compared to what I have on the market, it has a biological activity X, and I want to improve this biological activity, or improve its toxicity.”*

Another research laboratory is the Nanotechnology Laboratory (NALA)<sup>23</sup>, which is focused on the research into new technological platforms based on nanotechnology, which can be applied to medicines, cosmetics, and nutritional products. This laboratory was created in November 2017 and develops really new innovation projects.

The manager of the laboratory explains its origin.

*“There is a part of our strategic planning that says which are the pharmaceutical technologies that we need to innovate. About five years ago the most promising technologies were identified. The first that appeared was nanotechnology. That is why Pharm invested in this laboratory.”*

The laboratory is focused on the research and development of new technological platforms based on Nanotechnology, which can be applied to drugs, cosmetics, and nutritional products. As the manager states.

*“When I think of nanoparticles for drugs, I am looking for radical innovation. I can have a solution that allows people to take them fewer times a day or with a lower dosage, for example. I can change the route of administration of a medicine.*

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<sup>22</sup> Available at <[http://www.ache.com.br/relatorioanual-2017/pt/wp-content/uploads/2018/05/DFs\\_RA\\_Ache\\_2017\\_completo.pdf](http://www.ache.com.br/relatorioanual-2017/pt/wp-content/uploads/2018/05/DFs_RA_Ache_2017_completo.pdf)> Access on May 28, 2018

<sup>23</sup> NALA is a fictitious name. This dissertation cannot use the correct name.

*From injection to oral absorption. This is not incremental innovation. I try to improve the features I would not manage to with simple formulations.”*

The NALA laboratory is a co-sharing investment between Pharm and a Swiss company. The CAPEX resources are necessary to build and maintain the laboratory equipment and infrastructure. IF also uses OPEX financial resources for radical innovation project portfolios (synthetic innovation project portfolio and phytomedicine innovation project portfolio).

Pharm dedicates financial and human resources and laboratory infrastructure to IF necessities, especially for the discovery of new pharmaceutical assets (molecules). The financial resources are pre-defined annually, and the human resources are established according to the technology competencies of the laboratories, as the Laboratory of Design and Molecular Synthesis manager noted.

*“In general terms, 10% of the net revenue goes to R&D. A part goes to R. And what's left to us (Radical Innovation Nucleus). He (the director of the Radical Innovation Nucleus) receives an amount that has grown gradually over time. He shares the resources according to the synthetic and phyto portfolios.”*

During the period of the budget forecasting (usually at the end of the second half of the year), the managers of the innovation project portfolios and the director of the Radical Innovation Nucleus estimate their resource needs for the following year. Then, following the internal innovation committee<sup>24</sup>, the financial allocation of resources is defined, as explained by the manager of the radical innovation integration process.

*“We have an annual budget. How much will be invested in innovation projects is previously defined. When we approve the projects in the innovation committee monthly meetings, we already consider the budget. By the end of 2017, we had already submitted the project submission schedule and a budget estimate for 2018 to the board. So we already had a pre-allocated budget for the projects. When the innovation committee meeting takes place, I ask for permission to use the budget.”*

However, as well as CompAuto case, the predefinition of the financial support brings the IF to a problem. It is impossible to accurately pre-define the financial requirements for the innovation project portfolios. In the Pharm case, the first solution is to expand the manager’s flexibility to use the allocation of resources, especially finance up to a predefined limited (R\$ 3 million can be decided by the innovation committee).

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<sup>24</sup> In the following topic, the role of the innovation committee will be analyzed.

*“We accelerate or decelerate projects according to our availability of resources. Sometimes when it overruns or we already imagine it's going to overrun, we have to take it to the innovation committee to justify it, but first I align with the board here. It has to be worth taking to the committee (...) If a project requires up to R\$3 million it can be approved in the innovation committee. If it is more, I have to involve the board of directors.”*

However, this type of flexibility is not necessary for the IF to achieve its aims. As noted by the interviewees, the predefinition of the budget can limit the discovery of new pharmaceutical assets. The manager of NALA noted that he has a predefined budget, R\$2million, however:

*“Within the R\$2 million, there is a part that is destined for prototypes. This is meant for me to spend as I please. ‘At my leisure’ (...) If I cannot do everything I need within the R\$2 million, I have to leave it for the next year.”*

The alternative for Pharm is to borrow additional resources. The IF Directorship (Director of Radical Innovation Nucleus and Director of Innovation Nucleus) and the C-Level of the Pharms try to establish partnerships. As commented by the radical innovation integrator:

*“In the case of Radical Innovation, we seek to prioritize projects with greater market potential, a greater degree of innovation, or a partner for co-development that is interested in the project.”*

An alternative is to access external CAPEX and human resources. As noted by all the interviewees, the firm needs to explore new partnerships to borrow resources. In this case, there emerge exploration projects with partnerships such as other established pharmaceutical firms and/or scientific technological institutions. These projects are internally called strategic projects and have a separate financial, human and infrastructure allocation for OPEX investment. As pointed out by the manager of the innovation of phytomedicine project portfolio.

*“For larger projects, especially partnerships with universities, we create our own governance. This makes it easier to allocate resources. It does not follow the same rule for the allocation of resources. A separate cost center is created, and this does not compete with the resources of my portfolio (phyto) and the NONO portfolio (synthetic). A committee of its own is set up. This is all to ensure the prioritization, faced with all the projects that are in progress in the firm.”*

Furthermore, in terms of external partnerships with other established firms, there is co-investment with the Capex and Opex investments. The NALA laboratory started its activities as a result of co-investment between Pharm and an established Swiss pharmaceutical company. This is a co-sharing laboratory for both firms focused on

developing technological platforms. In same situation, they have common objectives. The R\$ 7 million<sup>25</sup> of the co-investment includes CAPEX and OPEX resources. As explained by the laboratory manager:

*“We defined two technology platforms: lipid nanoparticles and nanocrystals. So we are focused on these two platforms. The molecules are selected according to the strategic interest of each company. Sometimes Pharm has interests different to NONO. Pharm has an interest in the molecules for acne, hair loss. NONO has molecules to treat other diseases. Sometimes there are common interests. We have a contract, if there is a common interest, NONO will co-invest in the project. If it is only in the interest of Pharm, it invests in the project, but NONO will have to have a posteriori participation, since it also invested in the laboratory (...) We have a specific NALA team that has been approved by the two companies. NONO pays half of my salary and Pharm pays the other half. The entire structure is the investment of both companies.”*

#### **4.3.3. Integration practices for the Innovation Function to borrow resources**

The IF function is involved in three integration practices. One is the *assessment committee meetings* to analyze innovation project portfolios and deliberate on new additional financial resources or personnel for the projects. The second is the existence of an *integrator, a radical innovation integrator*. There is the third integration practice: *regular integration between strategic planning, the new business team and the IF team*.

The first practice is the regular assessment committee meetings. These meetings consist of monthly and annual meetings between the innovation committee, the CEO, and the Pharm board, and monthly Innovation Nucleus Directorship validation meetings. They have clear objectives, a predefined agenda and deliberate on the allocation of resources.

*“The agenda lasts three hours, and projects are discussed for about 20 minutes each. So there are about nine projects. Each year we evaluate two to three projects in the meetings. In 2018, for example, we will evaluate three Radical Innovation projects, three projects for gate passage, and three for initial approval (for the initial discovery phase).”*

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<sup>25</sup> Available at <f [http://www.ache.com.br/relatorioanual-2017/pt/wp-content/uploads/2018/05/DFs\\_RA\\_Ache\\_2017\\_completo.pdf](http://www.ache.com.br/relatorioanual-2017/pt/wp-content/uploads/2018/05/DFs_RA_Ache_2017_completo.pdf) > Access on May 28<sup>th</sup>, 2018

The radical innovation integrator clarifies that the Innovation Nucleus Directorship validation meetings aim to:

*“We annually prioritize the discovery projects to achieve the strategic goals. The financial aspects for the discovery projects are not included in these goals. The most important thing is to evaluate two things. The potential effect of a molecule and the feasibility of proving the effect. We are more interested in knowing how far I am from proving such an effect. This is for us the feasibility (...) The assessment of merit to determine who will receive resources is made annually with all directors and the CEO. Every month we report to this group of all the directors. Thus, we revalidate the importance of the IR projects for the whole company.”*

There is at least one limitation of the annual innovation committee meeting. All the Pharm directors take part in the innovation committee, including marketing, new business, operations and logistics, legal, regulatory, production, operations directors. As a result, there is an asymmetry of information as none of them has the same background to decide on the project development of new pharmaceutical assets. The radical innovation integrator emphasizes that they need to be evangelized to make their decisions. The Radical Innovation team learned how to evangelize. As the radical innovation integrator explains:

*“Our language was very technical. It needs to be adapted so that all the directors on the innovation committee can understand it more clearly. We spent a lot of time adjusting the best way of presenting radical innovation projects at committee meetings. We had to find the simplest possible language. It is no use talking about a ‘this is a new project that deals with a new action mechanism that is being well accepted by the medical profession.’ Maybe this is not the best language. I need to talk in a less technical way. We have to talk more about market trends, treatment trends available around the world, and how this project fits into these trends. This needs to be very didactic in the pre-books. Or I have to talk like that. For example, it is no use saying to the committee, ‘I have finished the XYZ phase and now I am going to do the scheduling of the active principle and start developing the formulation.’ They do not understand that. I have to explain in a way that they understand. I must say, for example, ‘I have completed the safety assessment of my active principle. We have been able to observe that this active principle has proved to be safe to administer in humans and, for this, I need to increase the scale of production. So I need a bigger budget, and so on.’”*

There is also another *assessment committee* meeting which refers to the assessment of the NALA laboratory projects. These committees are not the same as the innovation project portfolio committees and have different components, with representatives (Directorship and C-Level) of the external partner, the Board of Directors and the C-Level at Pharm.



*“How do we define the projects? There are the steering committees with members of the two companies. It takes place twice a year. Based on the 2016 workshop, we defined two technology platforms: lipid nanoparticles and nanocrystals. So we are focused on these two platforms. The molecules are selected according to the strategic planning of each company.”*

The second integration practice is *the existence of a formal position in the organizational chart, which is called a radical innovation integrator, who is responsible for the integration process of Radical Innovation Nucleus activities with the further phases of the drug development process. One of the managers of the innovation project portfolio explained the importance of the radical innovation integrator as: “he’s the one who puts the wheels on our molecules so they can roll”.*

As cited, the IF innovation project portfolios covers phases one and two of the drug development process and extend from idea innovation project generation to the assessment of the investment proposal presented to the CEO assessment during the annual innovation committee. As noted by the Radical Innovation Nucleus director during all this process, 22 internal areas are consulted until a proposal is made to the CEO, taking around four to five months to conclude.

The radical innovation integrator describes his responsibilities:

*“For the projects in the phase of discovery, I go deep into the technical evaluation. I am already involved in other areas of the company such as analytical, pharmacotechnical development. I go further into the scientific and technical documentation, and I also check with the clinical research personnel because it’s important to understand whether there are any restrictions with regard to patients. If I have to discard some kind of pharmaceutical formula, I talk to the medical staff to see if there are any restrictions (for example, in the case of drugs prescribed by a psychiatrist I have to think of drugs that can be broken down — the film-coated ones cannot).”*

The existence of the radical innovation integrator results from the need to facilitate the involvement of various competencies during the early stages of the radical innovation projects at Pharm. As the integrator manager explains, at the beginning of the Radical Innovation Nucleus performance, radical innovation projects, especially in the discovery phase, were not visible to the entire company:

*“When we needed to involve other people within the firm, we always had difficulties. Either people did not understand what was exactly the project, or it was not prioritized because it was not within Pharm’s current objectives”.*

The integrator aims to reduce project failures that are due to difficulty in finding technical expertise within Pharm, precisely the three phases: preclinical, scheduling and formulation. As he details:

*“I need to involve other areas: analytical development, pharmacotechnical development, clinical research, and marketing, for example. And also the area of new business always has someone to contribute. When the committee approve projects, they approve a scientific idea and a budget to prove this scientific idea that includes the discovery phase. From the moment I can select a candidate (project) to enter development is when these projects migrate to my area. It is necessary to fill out forms specifically created for radical innovation projects, to gather the necessary information about what I need to do in the next phase, how much it will cost, what my schedule will be.”*

Another practice is the *integration between strategic planning, new business team, and the IF team*. The strategic planning team has a formal periodical delivery to drive the IF team projects. Internally, this delivery is called the “warzone”, a formal output consisting of the alignment to market or driven technological needs, as noted by all manager interviewees.

*“Inside the warzone there is a part that tells us what are the pharmaceutical technologies we need to innovate. About five years ago the most promising technologies were identified.”*

The IF team tries to capture the information from the strategic planning and new business teams. The latter is focused on assessing new markets for Pharm for its current products. The radical innovation integrator sums up this internal functional alignment as follows.

*“About the warzone, we work very closely with new businesses. They identify the needs. The new business area drives the warzone. Several hands make the warzone. There is information from the market and therapeutic areas. We (radical innovation nucleus) try to identify the therapeutic target that is not being attended to. So we're studying this target here.”*

Table 20 provides an overview of the three integration practices observed in Pharm case.

**Table 20 - Integration practices at Pharm**

| <b>Practices</b>  | <b>Frequency</b>  | <b>Responsible</b>   | <b>Benefits</b>  |
|---|---|--|--|
| <b>Committee meetings</b>   | Annually and monthly: innovation committee<br>Monthly: innovation directorship meetings | Director of innovation nucleus   | Evangelize innovation committee members.   |
| <b>Radical innovation integrator</b>  | Continuously  | One person formally recognized internally and reporting directly to the director of the radical innovation nucleus | Link the output of the innovation project portfolios to the scale up, especially for the manager of phase 2 of the drug development process. |
| <b>Regular if team, new business team and strategic planning team alignment</b> | Continuously  | IF, new business and strategic planning teams  | Offer market or technological drives for th IF team.<br>Help the ideation of the innovation project portfolios.                              |

Source:The Author

Table 21 highlights the different IF borrowing resources context, the consequences, and the IF team efforts.

**Table 21 - Summary of the Innovation Function borrowing resource context at Pharm**

| <b>Perspectives</b> | <b>Borrowing resources context</b>  | <b>Consequences</b>   | <b>If efforts</b>  |
|---------------------|---|---|--|
| <b>Firm</b>         | Need to follow Drug Development Process   | Radical Innovation team, consisting of R side of R&D.                   | Establishment of the Radical Innovation Integrator position  |
| <b>Portfolio</b>    | Annual predefinition of the resources for the two innovation portfolios and laboratories. | Limited financial resources predefined annually.                        | Flexibility for managers to use the resources<br>Evangelization of the innovation committee members. |
| <b>Project</b>      | Focus on new technologies for known markets.  | Broad internal integration covering different organizational functions. | Search for additional resources.   |

Source: The author

## **5. Discussion**

This chapter focuses on comparing the data from cross-case analyses with literature. To guide the methodological aspects of the analysis, Eisenhardt (1989) suggests two reflections. "What am I learning?" and "How does this case differ from the last?" These questions opened out opportunities to understand new relevant information from the case studies not covered by the literature.

The discussion of the three cases attempts to look for case similarities and differences. This chapter is divided into six topics. The first topic characterizes the construct "to borrow", according to collected data. The second topic identifies that the IF can adopt four different approaches for borrowing resources. The third topic recognizes that each approach for borrowing resources generates a side effect. A side effect means a possible secondary effect, typically undesirable effect, or possible unwanted consequence caused by each approach. The fourth topic states that the IF needs to face different struggles. The fifth identifies the integration practices carried out by the IF to borrow resources. The last topic of this chapter includes the analysis of the propositions and the building of the extended conceptual model, based on the literature review (Chapter 2) and the discussions from the empirical research (Chapters 4 and 5).

### **5.1. Construct "to borrow"**

The first aspect of the discussion refers to the construct "to borrow". As mentioned before, this term comes from Govindarajan and Trimble (2005) and was adapted for IF context. Here, "to borrow" refers to the necessity of IF to obtain resources within the parent firm for the development of the radical innovation projects. It does not only refer to financial resources, but also for the temporary use of non-financial resources (e.g., internal laboratories, equipment, and human resources).

Regards to non-financial resources, IF needs to return the resources for the owner or responsible. From a broader perspective, "to borrow" can be adopted when it is necessary to use resources (using of the pilot plant or laboratories resources), but with the expectation by the lender that the resource will return to them. On one side there is the owner or the responsible of the resource (a Business Unit, for instance) that can lend someone (the IF) a resource (e.g., pilot plant) for a determined period. However, regards

to financial resources, IF has not this return obligation, however, he needs to allocate to the radical innovation projects.

The IF might use its predefined financial budget (CompAuto and Pharm cases – remember that in these two cases, IF has an annually predefined resources and will demand additional ones to radical innovation projects) or not (Quim case – remember that in the Quim case IF needs to sell the radical innovation projects to the BUs or is dependent on corporate leadership interest to persuade the BUs).

As noted in the Quim case, the findings from the research field underscore specific situations referring to borrowing resources when the IF needs to find complementary manufacturing assets from the business units (pilot plants or particular equipment for a fixed period). As cited above, one Quim IF manager declared that in a project,

*“We did not have to buy new equipment. We do not need to spend to make a pilot plant. Because we already have it. The investment would only be OPEX, just the human resources of our team to adapt the required technical specifications, such as rigidity and durability. We changed the additives, for example. We had had the polymer technology<sup>26</sup> since 2004. It is on top of the development of a product that we already knew.”*

Besides, the CompAuto case also reveals that the construct “to borrow” can be adopted when it is necessary to use internal non-financial resources (e.g., human or laboratories) and also with the expectation by the lender that the resource will return to them. As well as the Quim case, on one side there is the owner of the resource (a Business Unit, for instance) that can lend someone (the IF) a resource (e.g., human resource) for a determined period. However, the IF uses financial resource to borrow the human or laboratories hours. It is not a buying process, because the radical innovation project demands the resources for a specific period.

In this situation, the radical innovation project portfolios (technological incubation portfolios and new product portfolio<sup>27</sup>) are funded by a predefined budget. As usual, in established firms, this definition takes place once a year, according to the global firm’s

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<sup>26</sup> Made from renewable sources instead of oil. We occulted the name of the product to maintain the firm unidentified.

<sup>27</sup> As indicated before, in the CompAuto case the new product portfolio refers to the stricto sensu definition of radical innovation as described by O’Connor et al. (2008). Here it refers to new business platforms, which aims to change the firm’s growth, based on radical innovation projects. The technological incubation portfolios are related to our definition of really new innovation, with low market uncertainty but high technology uncertainties and address the known market of CompAuto but with an unknown technology process.

intents. In the Pharm case, similarly to CompAuto, there is also an annual predefinition of the financial resources. This funding is mainly focused on the beginning of radical innovation project, that is, molecule discovery according to predefined medical targets.

In CompAuto case, the resources lent to the IF are generally the human resources and infrastructure (such as laboratories used to test concepts for technological incubation portfolio projects). The global manager of new business platforms revealed that, during the discovery activities, to prospect new opportunities beyond the current products and markets, there was the need to involve around 30 people from different internal areas:

*“From a worldwide perspective, there should be about 30 people, but part-time, which would amount to about ten people full-time, only two or three at the most are full-time. The people are from other areas, sometimes not necessarily from the business area, but they are providing services that contribute to the elaboration of business cases. People from the laboratory area, the engineering area or even from other business units.”*

In this case, the use of the human resources or laboratory facilities are based on the expectation by the lenders that the resource (*about 30 people supporting activities to discover opportunities*) will return to them (by a specific deadline, which can be postponed or brought forward according to the particularities of each project). In this way, the IF at CompAuto borrows already existing human resources or laboratory testing equipment in the parent firm.

This is a different situation from that of Quim, which does not have a predefined financial resource allocation even to start a radical innovation project, mainly the discovery of new business opportunities (discovery as stated by O'Connor et al. 2008). However, the resources predefined in the CompAuto and Pharm cases are not sufficient, for the whole development of the projects. As pointed out earlier, the IF portfolio managers at the CompAuto case also need to borrow human resources internally from different business units or to perform laboratory tests. However, the managers need to negotiate with the business unit or laboratory responsables, and, as a counterpart, these costs are allocated to the IF “cost center”. And, in a more mature phase of the project – mainly in Acceleration - in O'Connor et al. (2008) terms -, often there is the need for capital expenditures (Capex), that is, investments in scaling up or production physical capacity.

## 5.2. Approaches for Borrowing Resources

According to the three cases analyzed, emerged different characteristics related to borrowing resources for radical innovation projects. The cross-case analysis shows four different alternatives for the IF borrows resources for radical innovation projects. These approaches are called here as “approaches for borrowing resources”.

The four approaches can be summarized as follows.

### **Approach 1: Initial resources through BUs leadership support**

Borrowing resources by selling projects to the current business units<sup>28</sup> – Quim Case

IF adopts a proactive approach to selling the projects to the current business.

### **Approach 2: Initial resources through Corporate leadership support**

Borrowing resources from the current business units, by corporate leadership persuasion – Quim Case

IF depends on the corporate level (C-level) persuasion current business units to lend resources to radical innovation projects.

### **Approach 3: Additional resources from BUs**

Borrowing resources from the business unit, after previously receiving financial resources from the corporate level – CompAuto Case

The IF partially has the financial resources for radical innovation projects. The Corporate leadership devotes prior financial resources to the IF. However, the IF needs to borrow additional resources from the business units.

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<sup>28</sup> As appointed on topic 2.5., for this dissertation the meaning of corporate level and business units regards to Bowman and Ambronisni (2003)'s and Gupta and Govindarajan (1984)'s definition. Bowman and Ambronisni (2003) state that corporate level includes the person responsible at the high hierarchical level of the established firms (e.g., C-Level of the firm or Vice-Presidents). One of the main role of the corporate level is to oversee, support or increase the primary activities of the Business Units. Established firms can be made up of multiple Business Units. For Gupta and Govindarajan (1984), a Business Unit is a profit center within the firm, which focuses on product offering and/or a market segment. Each BU is responsible for its own profitability and requires specific strategies, project portfolios, management skills, key success factors, competitive positions.



#### **Approach 4: Additional resources from Corporate Level**

Borrowing resources from the corporate level, after previously receiving financial resources from the corporate level – Pharm Case

The IF partially has the necessary resources for radical innovation projects. The corporate leadership devotes prior financial resources. However, the IF needs to borrow additional resources from the corporate level. In the Pharm Case, the radical innovation projects have previously received financial resources; however, the IF borrows human and laboratories resources from co-sharing investments at Pharm.

#### **Approaches 01 and 02**

The Quim case portrays the approaches centered on business units' decision to borrow resources. In this case, there are two different approaches. In both, Quim does not previously allocate the necessary resources to radical innovation projects.

**The first approach – Borrowing initial resources through BUs leadership support** - refers to the need of the IF to “sell” to a current business unit a project to be initially developed, that is, to be developed to a certain degree, a kind of discovery phase. It especially considers borrowing resources (e.g., pilot plants) and human resources from the BUs for radical innovation projects. As described earlier, the BUs act as the “buyer” of innovation projects from the IF, at least in its initial phases.

In this case, as pointed out at the last chapter, many CAPEX resources for radical innovation projects already existed within the parent firm; however, the IF needs to ask the business unit to lend them. As pointed out by the innovation coordinator, it is an attempt to convince the “guys (*those responsible for the BUs*) to pay for us”, especially, Capex resources for the adjacent and transformational project portfolios. The case of Quim demonstrated that in order to get funding, the IF might need to hunt for underused internal resources. As stated by the Quim innovation manager:

*"Most often, I do not start from scratch [carrying out a project that will depend on the acquisition of assets]. Because I can make use of the assets that already exist. For example, I already have two nuclear magnetic resonance machines. I'm not going to buy a third one. I borrow it. Another situation, I have seven pilot plants in operation, so I try to make use of them."*

**The second approach – Borrowing initial resources through corporate leadership support** - refers to borrowing resources for the projects where the corporate

level request the BUs to fund them. Slater et al. (2014) explain that this situation occurs when there is project sponsorship from the high corporate level interested in guaranteeing the project development. However, in this case, even the higher sponsorship, the funding is divided into parts. The project is funded only up to a predefined milestone, then the funding need to be discussed after.

In the Quim case, as the project evolves, there is a bit pressure for BUs leaders to engage in RI projects, lending resources at least their initial discovery activities. In this approach, BUs lend the resources to the IF because corporate leadership (CEO, C-level and/or Vice Presidents) acts as the major sponsor. This leadership constantly discusses the need for more radical innovation projects with BUs leaders, and with functional leaders as well.

This situation normally occurs in Quim case through the involvement of the CEO. As mentioned by the innovation manager, a common and provocative position of the CEO is to ask to avoid short-term projects *“These portfolios are too often going toward strategic cost reduction intent, shouldn’t they be going toward a more long-term strategic intent?”*

According to the innovation manager, The Quim CEO argues that at the directorship level there should be more focus on innovative project portfolios. As pointed out in the Chapter 4, one example is the development of a basic chemical from renewable sources. The idea was based on a 20 year long technology roadmap. A committee of the CEO and VPs decided to continue the project.

Considering the two approaches in the Quim case, the IF needs to convince the BUs to lend resources or is dependent on the corporate level (e.g., CEO and Vice Presidents) request to the BU to lend resources for particular projects. In both approaches, the source to borrow is the Business Unit. In the first approach, however, the Business Unit is the major actor responsible, with authority for deciding on the financial, human, infrastructure and other necessary resources to lend to radical innovation projects. On the other hand, in the second approach, the major actor responsible is the corporate level (C-level and corporate Vice Presidents) leadership. The Business Units follow its requests and lend the resources to the projects.

### **Approaches 03 and 04**

The CompAuto and Pharm cases refer to borrowing through the corporate level. Both firms predefined initial financial resources allocated to the IF for initial phases of radical projects, mainly discovery and some incubation.

**In the third approach – Borrowing additional resources from BUs** - (case of CompAuto), the financial resource allocation to the IF is carried out globally by the corporate leadership (C-Level and Vice Presidents), formally inserted in the annual budget of the firm. The financial resources come from the corporate level. There is a corporate resource. As pointed out by the manager of technological incubation portfolio:

*"The definition is prior and carried out globally by the board (...) the percentage going to each of the portfolios is different. The directorship decide."*

IF can use the initial funding, for instance, to borrow internal laboratories hours or engineering hours. As the global manager of new business platforms clarifies:

*"The team related to the innovation area is usually focussed on coordination or project management. When we have to carry out a specific activity, for example, search for new concepts, develop or analyze a technical aspect necessary for a new business case, we use human resources from other areas (e.g., engineering, research and development, manufacturing). So a great articulation with other areas is needed. And, therefore the dispute is not simple".*

The initial decision to define the funding is centered on the board of the firm, not on the business unit's leadership. The manager of radical innovation project portfolios, in turn, have the flexibility to use this initial resources. As cited by a manager of really new innovation portfolio (called as technology incubation portfolio) *"for incubation technology I can spend here in the region as I wish"*. However, as known, the corporate level and the managers of the portfolios know there is no way to previous allocate all the resources precisely. Then, the IF managers need additional resources. The allocation of these additional resources depends on the corporate level decision. In the case of CompAuto, for example, the manager can receive additional financial resources, annually by, for example, the innovation committee decision with the C-level. The financial resources are allocated to the IF "cost center" and the managers have autonomy to use the financial resources to borrow, for instance, technical and human resources, which belong to the Business Units.

For example, in some situations, the global manager of new business platforms needs to borrow engineering, which belong to the R&D department in England for a specific period in specific projects. And as a project evolves, a need may appear to borrow five engineers. He noted that a common situation is the impossibility to estimate this necessity for human resources previously. For example,

He explains that there are specific steps to follow. Initially, there is a simple decision.

*“It can be decided between me and the innovation representative in England, for example, and a discussion with him to understand the degree of occupation of the innovation activities there, whether the request that I make can simply be covered by the level of non-occupation by the English team, we have quickly found a solution. CompAuto encourages this kind of interregional cooperation”.*

However, borrowing human resources maybe not so easy, even with a predefined budget for IF. The global manager of new business platforms notes that it may be necessary to involve the directors of the region. If this is not conclusive, there is the possibility of involving the global R&D and VP to make the best decision.

**In the fourth approach – Borrowing additional resources from Corporate Level** - (Pharm case), there is also a pre-defined financial resource allocation, according to corporate level interest. Nevertheless, the IF needs additional resources and has to convince the corporate decision makers to lend these resources. The IF team (managers and directors) can interfere in this resource allocation and require a negotiation process with the corporate directorship and the CEO, who are considered here as the corporate decision makers for the IF to borrow resources.

*“There is our definition (of the resources intended for the coming year) as an area (Nucleus of Radical Innovation), the NONONO (the Director of the Nucleus of Radical Innovation) leads, we seek to prioritize according to expected results and alignment with the company strategy. He subsequently takes it to the Innovation Center (second instance), and then the board and CEO (third instance)”.*

However, The Pharm case differs from the CompAuto case. The Pharm business units are not involved in lending additional resources to radical innovation projects as at CompAuto, and the IF attempts to obtain co-investment from Capex and Opex for the radical innovation projects. The NALA laboratory is an alternative, and the IF borrows the NALA facilities (equipment and laboratories) and its human resources.

As pointed out by the NALA manager:

*“The NONONO (manager of the Laboratory of Design and Molecular Synthesis) gives me a molecule and I do the initial tests here within the budgeted amount for prototypes. If we have promising results, I can take it to the committee for the director of radical innovation director and his peers to decide whether or not to create a new project. There is just an initial concept of a project, without using [financial and laboratory] resources. If it has the potential, we take the initial concept to the NALA committee (already structured with high level members from Pharm and NONO). If we get the ok from the NALA committee, then I can get resources to develop the project and use people from the Nucleus of Radical Innovation. The Laboratory of Design and Molecular Synthesis manager can look for me, for example, when he sees no solution to a problem. Sometimes I can also help to find solutions for patenting. The NONO, responsible for intellectual property issues, looks for me. Sometimes there may be a molecule that is not innovative, but if we insert something, nanotechnology can give a patent. We can act and use the resources for prototypes. So there are two possible paths: helping the manager of the Design Laboratory and Molecular Synthesis to solve some problem or helping the intellectual property manager to insert something nano so we can patent.”*

To sum up, the four approaches, as observed, prior financial resources are important, but the IF will need to borrow other resources for the projects. The BUs or the corporate leaderships can take the responsibility to lend other resources. This differentiation establishes different approaches for borrowing resources. Each approach requires different integration efforts of the IF to borrow resources. As will be discussed below, therefore, the cases highlighted that the integration of the IF is different for each approach, requiring different struggles, integrators and practices.

### **5.3. Side effects of each approach for borrowing resources**

The cross-case analysis reveals that each of the four different approaches for borrowing resources generate side effects for the IF's attempts to borrow resources for radical innovation projects. This dissertation considers as side effect a possible secondary, typically undesirable effects, or possible unwanted consequences caused by each approach. The research findings reveal four side effects: i) the possibility of IF to become hostage to the short-term interest of BU or to the current markets or products current domains, ii) the possibility of the occurrence of external factors forcing the firm to a more conservative resource allocation, more concentrated on short-term BU's intention, iii) the possibility of IF does not borrow additional resources, penalizing its team, and iv) the

possibility of IF does not borrow additional resources, penalizing the current radical innovation projects.

**The first side effect**, as noted in the first case (Quim), refers to the BU intentions as the BU controls the allocation of resources for the radical innovation projects. This dissertation calls the first side effect as follows: becoming hostage to the short-term interest or the current markets or the current domains of projects.

In this dissertation, in the first approach, the Quim case demonstrates a limitation for the IF to search for new business opportunities far from the intentions of the current business units. The IF has a hard task to articulate the BUs to borrow technical workforce, laboratories, and financial resources. Especially in the Quim, the challenge is even more significant. There are institutional aspects in that difficult this articulation. For example, the BU leaderships' mandate tends to focus on short term results. According to the words of one innovation coordinator at Quim, the IF has to follow goals about annual launching projects:

*"In 2017, we had the goal of launching a pipeline with 350 projects a year and this pipeline is available according to an adjusted (by the risk of each project) net present value, predefined at the beginning of the year by the business unit."*

He confirmed that these goals favor projects with shorter deadlines, with lower risks. One of the main annual goals of the IF team is the achievement of this type of goal. As a consequence, in this case, the IF capacity to borrow resources is circumscribed by the business unit interests. According to O'Connor et al. (2008), it can, for example, inhibit the exploratory activities of the radical innovation projects.

This can be seen in the following dialogue with one innovation coordinator at Quim, during the interviews for collecting primary data. The first question aims to validate this argument (inhibition of exploratory activities) and the second tries to understand whether there is an alternative for the IF to explore new markets. There is an alternative. There is an internal team within Quim, which should be responsible for exploring new business opportunities. However, there was no one (on October 11, 2017) allocated to this team due to the corporate changes in recent years.

*Researcher: "If every project has to be previously negotiated with one business unit, and the business units are pressed for short-term objectives, does this situation leave you with a sense that projects will be more incremental?"*

*Innovation Coordinator: Of course. Welcome to our world. This is our drama.*

*Researcher: What if you have, for example, a project that has nothing to do with your current markets?*

*Innovation Coordinator: This goes into the new business area. We have a new business area that is there inside (he pointed to the slide where this area is located on the organizational chart). It is located inside the South America business unit of a main product platform, and within this unit there is an area called renewables. The new business area is within the renewable area. But, there is no one in this area today."*

It does not mean that the IF there is no importance or the Quim does not have radical projects. This dialogue occurred at the end of 2017 with middle level managers of IF. In parallel, complementary data were collected with the highest manager of IF. As discussed on topic 4.1.2 (from pages 114 to 118), IF since the end of 2017, has regained importance within Quim, by rebuilding new project portfolios, including the radical ones.

Besides, the second approach also generates its side effect as the IF depends on the approach of the corporate leadership to request current business units to borrow resources for radical innovation projects. **The second side effect** is the emergence of a vulnerable position of the IF, which includes external threats, economic crisis, C-level change or other negative phenomena to force the firm to adopt a more conservative resource allocation, more concentrated on short-term BU intentions. As observed in the Quim case, internal factors such as changes at the C-level or Vice President levels or external factors such as economic crisis can disturb approach of the IF to borrow resources.

In the Quim case, corporate board changes and an economic crisis affected the firm. Most innovative projects (transformational ones) were requested by the previous CEO, before 2016. All the interviewed of Quim portrayed that he was always in favor of radical innovation projects. However, after he left the presidency, an external economic crisis concomitantly attacked Quim. The corporate intention changed. As stated by one interviewee:

*"The structure changed. The focus too. What is the focus now? Is the focus on getting ourselves to invent the wheel or making money from incremental projects? What gives me more money in the short term?"*

As a consequence, on October 11, 2017, there were 343 innovation projects in progress. Around 40% of the projects are related to adjacent categorization (really new innovation) and 60% to core categorization. The transformational projects related to the radical innovation *stricto sensu* definition were put on hold or canceled.

**The third and fourth side effects** are related to the CompAuto and Pharm cases. The approaches adopted by the firms confirm the impossibility to precisely define the resource allocation for the radical innovation projects. As noted by the interviewees, *“sometimes it is too little, sometimes it is too much for the radical innovation projects”*. Slater et al. (2014), argue for the importance for firms to dedicate sufficient resources to radical innovation projects. As O’Connor and Rice (2013) pointed out, radical innovation projects are embedded with uncertainties such as resource availability, and in most situations, it is not possible to accurately define all the financial resources, infrastructure, and human resources required to complete the project tasks. Furthermore, as stated by many authors such as O’Reilly and Tushman (2003), Lettice and Thomond (2008), and Bessant, Oberg, and Trifilova (2014), resource allocation becomes difficult because radical innovation projects may require completely new human resources and infrastructure and compete for resources within the mainstream operation.

This dissertation agrees with these statements. However, empirical data also acknowledges two complementary side effects. As noted above, in the Pharm and CompAuto cases there is an annual predefinition of the financial resources for radical innovation projects. However, this predefinition is not sufficient as the IF must borrow additional resources, as previously highlighted.

The manager of one project portfolio at CompAuto declares that the annual predefinition of the financial resources for radical innovation portfolios generates the following problem. The managers understand that the predefinition is understood as a paradox to solve. She notes that *“if you try to spend more than you have in your predefined budget, the corporate leadership tells you off<sup>29</sup>. If you spend less, next year your budget will be reduced”*. In the Pharm case, according to one innovation portfolio manager, the scenario can be summed up as *“when I need more resources, I withdraw the resources from some other project or request additional resources”*.

These two situations illustrate an adverse scenario to devote resources to radical innovation projects. The expressions *“the corporate leadership tells you off”* (CompAuto case), *“next year your budget will be reduced”* (CompAuto case), and the position of the portfolio manager, *“I withdraw the resources from some other project* (Pharm Case)

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<sup>29</sup> The interview was in Portuguese. The original expression was *“você toma bronca da alta direção da empresa”*.



reveal an embarrassing situation or the necessity to accurately define which project will be prioritized to receive resources and which will not. The third side effect — “*the corporate leadership tells you off*” can be understood as a situation that the manager tries to avoid. The fourth side effect — “*I withdraw the resources from some other project*” — , can penalize other projects. In this situation, the IF must have the ability to borrow additional resources, or some projects will be handicapped.

Table 22 summarizes each of the side effect and highlights the evidence.

**Table 22 – Side effects of each approach for borrowing resource**

| <b>Approach for borrowing</b>                                    | <b>Side effect</b>  | <b>Evidence</b>   | <b>Case</b> |
|--|---|---|-------------|
| <b>1. Initial resources through BUs leadership support</b>       | Becoming hostage to the short-term interest or to the current markets or products current domains.  | “They (the business unit) pay everybody's salary here and the other expenses, even the coffee we are drinking here.”  | Quim        |
| <b>2. Initial resources through Corporate leadership support</b> | External threats, crisis, C-level changing or other contrary phenomena force the firm to more conservative resource allocation, more concentrated on short-term BU’s intention. | “We had many transformational projects. And then we were able to evolve. But as the economic crisis began to appear, the area of innovation was no longer required for transformational projects, but rather for adjacent and core projects.” | Quim        |
| <b>3. Additional resources from BUs</b>                          | Innovation Function must have the ability to borrow additional resources or the IF team can be penalized (“tell off” or has less money in the next year)                        | “If you try to spend more than you have in your predefined budget, the corporate leadership tells you off. If you spend less, next year your budget will be reduced”  | Comp Auto   |
| <b>4. Additional resources from Corporate Level</b>              | Innovation Function must have the ability to borrow additional resources or can penalize current radical innovation projects.   | “When I need more resources, I withdraw the resources from some other project or request additional resources”.   | Pharm       |

Source: The Author

#### **5.4.Struggles of the Innovation Function to borrow resources**

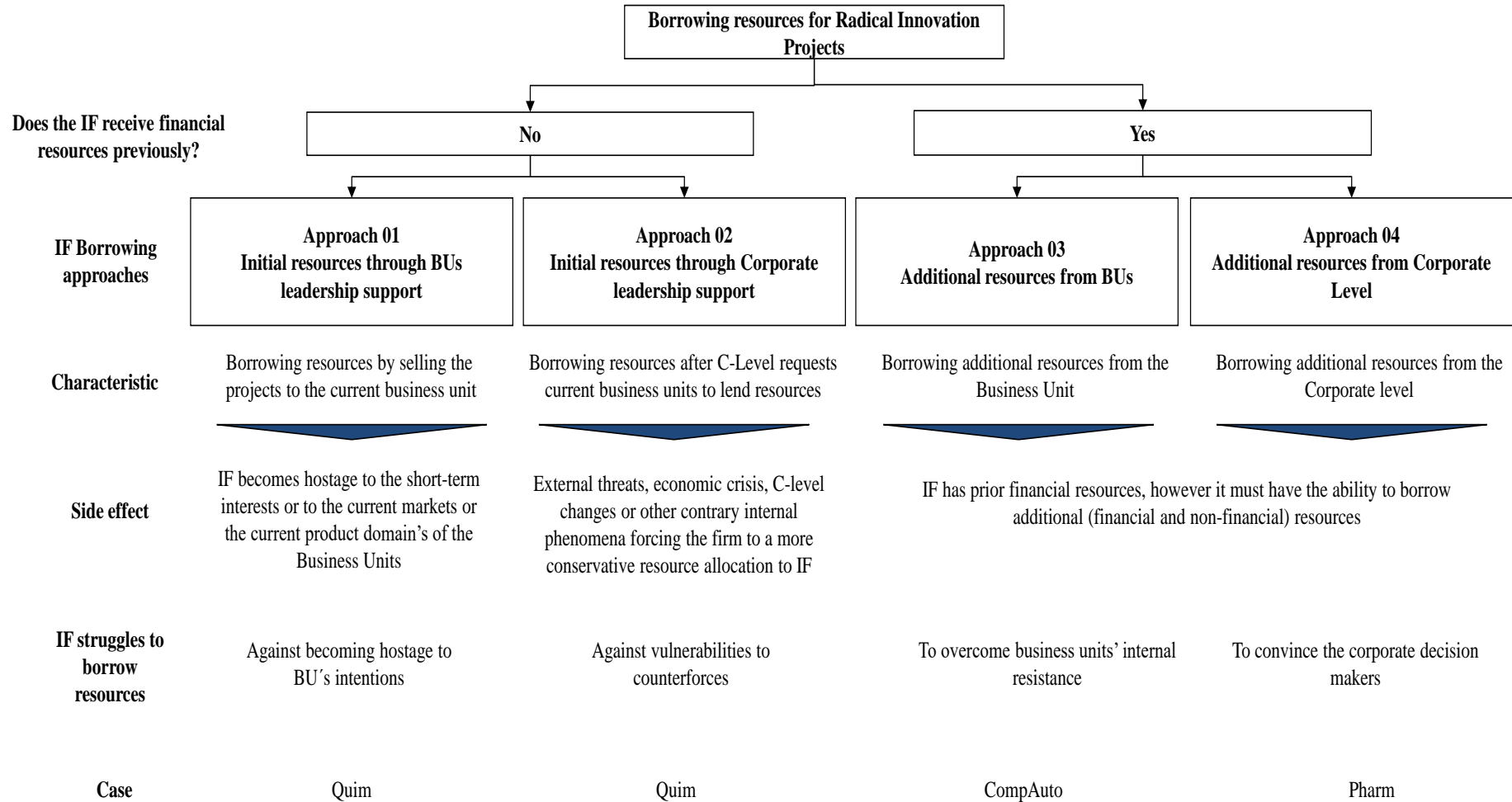
O'Connor et al. (2008) state that to avoid the decelerating or canceling movement of radical innovation projects, the IF needs to struggle to guarantee the necessary resources for radical innovation projects throughout all their development activities. In this dissertation, it was possible to deepen how the struggles manifest themselves.

The research field points out four different approaches for the IF to borrow resources, informing us that the IF needs to struggle for the continuous and systematic development of radical innovation projects in the firms. The struggle means the IF team activities to overcome the side effects or barriers of each approach to borrow resources for radical innovation projects.

Bagno (2014) explains that the IF needs to be far from the conflicts with the needs for operational efficiency, which is focused on short-term interest and ongoing products and markets. However, Bagno (2014) explains that keeping distance from these conflicts is not simple. In this way, for example, there is the struggle of the IF against becoming a hostage to the short-term interest, to the current markets, or current product domains (Quim). There is also the struggle of the IF against vulnerabilities to counterforces such as external threats, economic crisis, C-level changes in support, or hostile internal or external phenomena, in order to borrow resources (Quim). The struggle of the IF to go beyond the earlier predefined resources for projects, by overcoming business units' internal resistance (CompAuto) and the struggle to convince the corporate decision makers to provide additional resources (Pharm).

In short, the cross analysis reveals that each approach to borrowing generates specific side effects, which require a specific struggle, as shown in Figure 19.

**Figure 19 - Overview of approaches for borrowing resources**



Source: The author

The cross analysis points out that even in the cases of the three innovative reference firms, Quim, CompAuto, and Pharm, besides the side effects, there are barriers, which the IF needs to face. The Quim, CompAuto and Pharm cases show different struggles, which are related to different barriers.

As noted by Lettice and Thomond (2008), and Bessant, Oberg, and Trifilova (2014), many barriers can emerge. Sandberg and Aarikka-Stenroos (2014), and Bessant, Oberg, and Trifilova (2014) discuss the barriers of firms to allocate resources to radical innovation projects<sup>30</sup>. At least, two barriers, appointed by Sandberg and Aarikka-Stenroos (2014), are related to the collected data from this dissertation: i) the restrictive mindset and ii) insufficient resources.

According to Sandberg and Aarikka-Stenroos (2014) a restrictive mindset means the resistance to develop radical innovation projects within the firm, seen, for example, in the non-adherence of changing the current products, a culture that penalizes project failures, and conservative decision-making. The second internal barrier is insufficient resources such as finance, skills, experience, information, infrastructure, within the firm. The insufficiency means the non-allocation of resources for long term projects such as radical innovation. Sandberg and Aarikka-Stenroos (2014) state that many firms avoid funding these projects, focusing on known markets, products and customers, when they are facing an economic crisis.

A similar situation occurred in the Quim Case. The second approach (Quim) initially needed to face the following situation:

*“We had many transformational projects. And then we were able to evolve. But as the economic crisis began to appear, the area of innovation was no longer required for transformational project, but rather for adjacent and core projects”.*

However, the research findings reveal that as the IF started to struggle, a new scenario emerged, as mentioned by the general manager of the IF at Quim.

*“We are moving towards lenses that are a bit different from those of the core, adjacent or transformational. There will be four categories: 1) projects related to what I have today, regardless of whether it is short, medium or long term, whether it is incremental or not; 2) projects that leverage what I have today; 3) radical / disruptive projects; and 4) projects whose goal is to generate knowledge bases*

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<sup>30</sup> For more details see pages 91 and 92. According to Sandberg and Aarikka-Stenroos (2014), internal barriers originate within the firm and are related to its management and organization. External barriers originate from a firm's external environment and emerge when a firm interacts with other organizations or actors in economic and innovation systems; these include issues relating to, for example, the behavior of competitors, customers, partners, and governments.

*and not necessarily generate results. It is a category rather than exploration. The result of the projects is to develop competences.”*

Table 23 compares the description of the internal barriers, as pointed out by the literature, with each approach to borrowing resources, highlighting the side effects of these approaches and evidence of the cases which show struggles of the IF to deal with or avoid the side effects.

**Table 23 - Struggles and internal barriers for each approach for borrowing resource**

| Approach for borrowing   | Side effect  | IF struggles to borrow resources            | Internal barriers to Innovation Function struggles  | Evidence  | Case |
|--|--|---|---|---|------|
| <b>1. Initial resources through bus leadership support</b>       | Becoming hostage to the short-term interest or to the current markets or products current domains.   | Against becoming hostage of bu's intentions | Restrictive mindset   | <i>"two or three years ago, quim allowed himself to think outside the box for what fits outside the ordinary business units. Today we already have a discussion to treat more transformational projects in a broader sense, not restricted to one of the businesses. We're still trying "</i> | Quim |
| <b>2. Initial resources through corporate leadership support</b> | External threats, crisis, c-level changing or other contrary internal phenomena forcing the firm to a more conservative resource allocation, more concentrated on short-term bu's intention. | Against vulnerabilities counterforces       | Insufficient resources, such as financial, skills, experience, information, infrastructure, within the firm | <i>"we had many transformational projects. And then we were able to evolve. But as the economic crisis began to appear, the area of innovation was no longer required for transformational project, but rather for adjacent and core projects".</i>   | Quim |

|   |  |   |  |  |                 |
|---|--|---|--|--|-----------------|
| <b>3. Additional resources from BUs</b>             | <p>Innovation Function must have the ability to borrow additional resources or the if can be penalized (“the corporate leadership scolded you” or has less money in the next year)</p> | <p>To overcome business units internal resistance</p> | <p>Restrictive mindset</p>   | <p><i>"This project, for example, has been the subject of discussions, suggesting that it should have been interrupted by CompAuto several times. Therefore, I have to demonstrate this kind of discussion: we would not have some successful products as we do now, If we didn't have this type of project... Ah so this is cool."</i></p>  | <p>Compauto</p> |
| <b>4. Additional resources from corporate level</b> | <p>Innovation Function must have the ability to borrow additional resources or can penalize current projects.</p>  | <p>To convince the corporate decision makers</p>      | <p>Insufficient resources, such as financial, skills, experience, information, infrastructure, within the firm</p> | <p><i>"Our language was very technical".</i></p> <p><i>"We have a lot of meetings. So decision-makers tend to understand radical innovation projects more clearly. This helps in their decision-making".</i></p> <p><i>"At the moment, we are developing a tool to better explain to the innovation committees, detailing the reasons for choosing one project and not another".</i></p> | <p>Pharm</p>    |

Source: The author



Many examples from the research field can illustrate the struggles of IF and the barriers to overcome to borrow resources for radical innovation projects.

In CompAuto case, the IF team needs to focus on a defensive project perspective. The Global manager of new business platforms and/or the technical manager of radical innovation projects of CompAuto need to take a defensive attitude to avoid a reduction in the costs of the project. Here, emerge the defenders of the project, who are responsible for providing the protection necessary for the radical innovation projects against the competition for resources with other business units and current product improvement projects. Benner and Tushman (2003), O'Connor et al. (2008), Burgelman and Valikangas (2005), Govindarajan and Trimble (2005), and Kelley (2009) support the arguments in favor of defenders of resources for radical innovation projects. As already mentioned, at CompAuto there is a collaborative project, with several firms, headed by CompAuto, and the Massachusetts Institute of Technology (MIT). This project is 16 years old and it is still ongoing. To maintain the continuous resource allocation of this project, the Global manager of new business platforms of CompAuto reports that he often needs to take on a defensive position within the firm currently. This project is still ongoing. To maintain the continuous resource allocation of this project, the Global manager of new business platforms of CompAuto reports that he often needs to take on a defensive position within the firm currently.

*"This project, for example, has been the subject of discussions, suggesting that it should have been interrupted by CompAuto several times. Therefore, I have to demonstrate this kind of discussion: we would not have some successful products as we do now, If we didn't have this type of project... Ah so this is cool."*

Besides, another side effect was observed in the Pharm case referring to the necessity for additional resources for radical innovation projects. It is known that it is impossible to predetermine precisely the correct the budget for radical innovation projects. Considering for example the radical innovation projects analyzed by Leifer et al. (2001), O'Connor et al. (2008), O'Reilly & Tushman (2013), Hill and Birkinshaw, (2014), and Birkinshaw, Zimmermann, and Raisch (2016), it is easy to identify that a preliminary budget estimate would not guarantee an appropriate resource allocation. Then, the flexibility to use the resources by IF managers, as observed in CompAuto and Pharm should be a solution.

However, the IF manager has the flexibility to take the resource of one project to allocate to another project. It can boost, for example, some projects but can also penalize others in the same portfolios. If the manager knew in advance what should be the most prominent radical innovation projects, taking the resource of one project to allocate to another (the “best project”) would not be a problem. Nonetheless, it is not an easy job.

In order to avoid penalizing projects, the IF team in Pharm Case informed that they identified how to convince the corporate decision makers, without taking resources from other projects. However, it is a difficult task. The IF team realized that it is necessary to reach an appropriate communication strategy during the innovation committee meetings, which include all the directors of the Pharm, who deliberate on the borrowing and lending of resources for radical innovation projects, deciding on resource allocation.

Not all members of the board of directors do not have a technical background, unlike the Pharm innovation team. There are directors of sales, purchasing, financing, and others without technological knowledge. As pointed out by the person responsible for the integration between the Radical Innovation Nucleus at the Pharm and the parent firm, during the innovation committee meetings

*“when it is a project that starts from a Marketing, it’s easy to decide. The discussions are quiet. Now, when I deal with projects with a high level of innovation, people tend to question them a little more, the investment tends to be higher. When, for example, I try to develop a new project for developing a new molecule here in Brazil, people want to see the project in further detail. Our language is very technical. It needs to be adapted so that all the directors in the innovation committee can understand it more clearly. We spent a lot of time adjusting the best way to present radical innovation projects at committee meetings”.*

Three different aspects in Pharm case permit to IF achieves a solution to borrow more resources and avoid taking resources from other projects, by convincing the corporate decision makers,: i) accessible communication for all Pharm directors; ii) regularity of the committee meetings (monthly meetings); iii) efforts to define criteria for supporting the Pharm decision makers. The radical innovation integrator provided the following details.

Accessible communication is explained as follows:

*“We had to find the simplest possible language. It is no use saying ‘this is a new project that deals with a new action mechanism that is being well accepted by the medical profession.’ Maybe this is not the best language. I need to talk in a less*

*technical way. We have to talk more about market trends, treatment trends available around the world, and how this project fits into these trends. This needs to be very didactic in the pre-books. Or I have to talk like that. For example, it is no use saying to the committee, 'I have finished the XYZ phase, and now I am going to do the scheduling of the active principle and start developing the formulation.' They do not understand that. I have to explain in a way that they understand. I must say, for example, I have completed the safety assessment of my active principle. We have been able to observe that this active principle has proved to be safe to administer in humans and for this, I need to increase the scale of production. So I need a bigger budget, and so on".*

The regularity of the monthly committee meetings helps as follows:

*"We have a lot of meetings. So decision-makers tend to understand radical innovation projects more clearly. This helps in their decision-making. In the past, we introduced radical innovation projects for an entire 20-year development. We only had updates, and it was not monthly. It took time. And it was terrible. The committee team wanted to more details of the projects. They did not quite understand what was going on. We stayed a long time and did not leave the place. The meetings were not productive. The fact that we now have more constant meetings, dealing with small parts of the projects has helped us a lot."*

Besides, the innovation manager explains the third aspect, efforts to define criteria to support the Pharm decision makers:

*"At the moment, we are developing a tool to better explain our projects to the innovation committee, detailing the reasons for choosing one project and not another. When I began attending committee meetings, I was questioned by the directors about why a certain project was chosen. They constantly ask, "Why do I as a director who is distant from your area know that one project might be better than another that you have analyzed?" This was always very difficult to answer. There's an analyst in my area who's working in development. He has various criteria and scores for the projects, with criteria on regulatory framework, intellectual property, market, scientific development. It is a matrix that gives points according to the content of the projects. At the end, I have a score. This is to make tangible what the board cannot. We do not put in any of the financial parts, but we know something as we have an aspect of market potential. But nothing about NPV's or things like that".*

### **5.5.Integration practices: actions of the Innovation Function and the integrators' roles**

This dissertation argues that it is necessary to go beyond the initial studies on differentiation and integration within ambidextrous firms (e.g., Tushman & O'Reilly; 1996; Jansen et al. 2009). The literature has shown that the top directorship team (e.g., C-Level) should ensure the necessary integration within ambidextrous firms. Considering

the IF occurrence described by the ambidexterity literature, our findings go beyond the top directorship support to achieve the integration between the IF and the parent firm.

This dissertation considers integration as a capability which should prevent the rejection of the resource to radical innovation projects. An important element here is the ability of the IF to borrow resources within the parent firms, whether from business units or corporate resources, with the aim of reaching the perennial resources allocation to radical innovation projects. According to O'Connor et al. (2008), even considering that most radical innovation projects will be aborted or rejected during discovery, incubation or acceleration, the IF needs to maintain its efforts to borrow resources for the projects.

Leifer et al. (2000) and O'Connor et al. (2008) bring various examples from their research in more than a dozen firms during the previous twenty years. Most projects might require years in the incubation activities to mature technology, market or business modeling. In some cases, a radical innovation project development takes around 20 years, with a high churn rate. Besides for the discovery activities, beyond the impossibility to also define previously, for example, most activities might require exploratory skills, such as scientific discovery.

In this way, IF may boost interaction with universities and scientific technology institutions to start exploring new knowledge, which can leverage further projects to be incubated. As informed earlier (pages 130 and 169), in the CompAuto case, there is a 16 years old project. During this period, the IF team needs continuously to find counterforces to protect the project against internal forces hostile to borrowing resources for this project.

The data reveals that IF adopts different integration mechanisms to borrow resources for radical innovation projects. These integration mechanisms can be focused on two aspects: i) the IF actions (similar as activities carried out by the IF team), and ii) the integrators' roles. The integration mechanisms are carried out by the IF and are related to the struggle that the IF needs to face in each approach to borrowing resources. As already mentioned, the data shows four approaches to borrowing resources, each with its struggle in favor of the IF. The first approach is "*borrowing resources by selling the projects to the current business unit*" and the struggle is to avoid becoming hostage to the BU's intentions. Here the manager of the IF aims to access the highest hierarchical level at Quim to persuade the directors to prevent the IF becoming a hostage.

Another illustrative action comes from the third approach: "*borrowing additional resources from the Business Unit, after previously receiving financial resources from the*

*corporate level*”. The IF team at CompAuto implemented different actions to overcome the business unit’s resistance to lending resources, and these actions can include the involvement of an external partner to improve the development of a radical innovation project, complementing the technological expertise or including access to public funding. The IF team argues that the additional resources to be borrowed will not necessarily be entirely from the business units as they can partially come from external partners and public funding agencies. These are actions adopted to overcome (or at least, to minimize) the internal resistance to the continuous allocation of resources to radical innovation projects.

The case of CompAuto reveals that the high level sponsor and/or the existence of the product champion are important to overcome internal resistance. Nonetheless, they are not sufficient in themselves. In CompAuto case, IF need to demonstrate that the project requires external partners (e.g., scientific and technology institutions such as MIT) or can be partially funded by external public alternatives such as Funtec and BNDES, which allocate around 90% of non-refundable resources. The additional resources borrowed from Business Units, in the CompAuto case, are complemented by external support.

In terms of the second aspect of the integration mechanisms carried out by the IF, the integrator, this dissertation found employees responsible for vertical or horizontal integration of the IF and other organizational functions (e.g. engineering, research and development), business units and/or corporate decision makers. These employees are seen here as taking on an integrator’s role.

The integrators are referred to by classic authors: Galbraith, Downey, and Kates (2001) define the integrators as "managerial, coordinator, or boundary-spanning positions charged with orchestrating work across units" (Galbraith, Downey, & Kates, 2001 p.137). This is similar to Tushman's (1977) concept of internal boundary spanning. That is, in the three cases, the integrators are individuals within the IF who have, or adopt, the role of acting as project defenders (CompAuto), hunter of resources (Quim and CompAuto), hunter of sponsors (Quim and CompAuto), orchestrator of strategic alignment (Quim), and the integrator process “owner” (Pharm – Integrator “*he’s the one who puts the wheels on our molecules so they can roll*”).

The hunter's performance within the discovery of the DNA Model is well covered by Leifer, O'Connor, and Rice (2001) and O'Connor et al. (2008), and, as described by Leifer, O'Connor and Rice (2001), the hunters have a proactive action, looking for new business opportunities, evaluating new ideas, trying to connect different people from different organizational areas to work together to propose new projects, searching for new ideas from laboratory engineering, marketing, sales, etc. Basically, the hunter as discussed by the literature focusses on prospecting ideas, evaluating them and trying to transform them into new projects, which could generate new business opportunities for the firm.

Leifer, O'Connor and Rice (2001) point out that one crucial premise for discovery competency is the ability to find within the firms experienced people that can contribute to sensing and seizing new business opportunities. For O'Connor et al. (2008) hunting is one of the most important skills to discover business opportunities. They argue that discovery competencies include creating, recognizing and elaborating new breakthrough business opportunities, based on radical innovation project portfolios. To carry out the discovery building block, the IF requires exploratory skills, including both scientific discovery and the ability to connect disparate bits of scientific and market trend information to describe a compelling opportunity. The hunter has a fundamental role and their task is not easy; moreover, good hunters are difficult to find.

During the data collection, the existence of the hunters and discovery activities emerged, with both hunters of resources (Quim and CompAuto), and hunters of sponsors (Quim and CompAuto). A hunter is a recognized person within the firm who needs to find sponsors or internal resources to borrow for the IF.

In the Quim, CompAuto and Pharm cases, the hunter also has a fundamental role. However, for the IF borrows resources, the cases reveal that more than hunting skills are necessary to discover new business opportunities. It is necessary to hunt sponsors and resources as the Quim case demonstrates:

- Internal resources to be useful for radical innovation projects. *"Most often, I do not start from scratch [carrying out a project that will depend on the acquisition of assets]. Because I can make use of the assets that already exist. For example, I already have two nuclear magnetic resonance machines. I'm not going to buy a third one."*

- Sponsor, *"We do not have the money. For example, the renewable area (located within the alpha business unit) has disruptive projects, so there we are pioneering. The C-level of the firm wants this kind of project. They often say: 'We think we have to perpetuate our product, our brand. Let's think about something new. The guy is banking this.'"*

The common aspect in the Quim, CompAuto and Pharm cases is the impossibility of to anticipate or to predetermine what are the actions of the IF or the integration roles before the existence of the struggle. The integration actions of the IF (actions or the integration roles) cannot be predefined before the IF starts to struggle.

### **Actions and integrators' roles according to each borrowing approach**

The IF carries out integration practices for each borrowing approach, which requires at least one action from the IF and one integrator, which need to be combined and are interdependent. For instance, there is the case of a hunter for an underutilized plant for use in a pilot test. Hunting underutilized resources is important, especially for specific projects and urgent demands. However, during the struggle against becoming a hostage of the BUs short term interest, carrying out hunter activities is not sufficient. The IF at Quim team, for example, need to reach the highest-level on the corporate ladder to change the corporate decisions about resource allocation for radical innovation projects.

Table 24 presents an overview of the actions and the integrator carried out by the IF for each approach to borrowing resources.

**Table 24 – Integration actions and integrator’s roles for each approach for borrowing resource**

| <b>Approach for borrowing</b>                                    | <b>Actions of the Innovation Function</b>  | <b>Integrator’s role</b>   | <b>Actions and the integrator help to</b>            | <b>Case</b> |
|--|--|--|--|-------------|
| <b>1. Initial resources through BUs leadership support</b>       | - Escalate persuasion practices: highest-level sponsorship   | -Hunter underutilized internal resources<br>- Hunter project funding sponsors            | Struggle against becoming hostage of BU’s intentions | Quim        |
| <b>2. Initial resources through Corporate leadership support</b> | - Try to change the resources allocation rules   | - Orchestrator of the strategic alignment  | Struggle against vulnerabilities to counterforces    | Quim        |
| <b>3. Additional resources from BUs</b>                          | - Find external partners<br>- Establish special protection   | - Hunter sponsors for funding the projects<br>- Hunter for additional external resources | Struggle to overcome internal resistance             | CompAuto    |
| <b>4. Additional resources from corporate level</b>              | - Incorporate lessons learnings in the innovation committee<br>- Align market and technology drivers | - Integration manager  | Struggle to convince the corporate decision makers   | Pharm       |

Source: The author



The following arguments detail the integrator mechanisms for each borrowing approach.

### **1. Borrowing resources by selling the projects to the current business unit – the Quim case**

In the struggle against becoming a hostage of the BU intentions, the IF attempts to increase persuasion actions. The IF manager aims to access the highest hierarchical level at Quim to persuade them to avoid the hostage position of the IF. In order to persuade them, different integrators' roles can be seen in the research field: hunter for project funding sponsor and hunter for underutilized internal or highly required resources.

The persuasion starts with a strategic attempt to involve the CEO to stimulate the business units to be interested in higher uncertainty projects such as the radical ones. The IF tries to encourage the CEO to foster projects which are not merely focused on the current market or technologies. The innovation manager knows that he needs this support from the CEO to avoid becoming hostage of the BU's short-term interests. It is an attempt to change, since the end of 2017, the portfolio composition and the firm's positioning as regards the radical innovation portfolio projects. As discussed earlier, Quim has boosted the higher uncertainty innovation projects in the highest hierarchical committee. The CEO is helping the IF manager, who announced:

*“Today we already have a discussion to treat more transformational projects in a broader sense, not restricted to one of the businesses. We're still trying. The CEO helps us a lot. He has the role of making people worried. It creates a sense of urgency. It provokes the VPs, the business unit directors. This helps us. Today the CEO is provoking and this will, I think, generate more long-term projects, more uncertainty that can change our level. In this case, we do not know what returns these projects will bring. These are projects that are not necessarily linked to the current business of today”.*

The innovation manager knows that the main results may not occur in the short-term. Besides, he tries to find (hunt) sponsors and underutilized internal resources, which can make radical innovation projects feasible. Thus the integrators appear, hunting for underutilized internal resources, which can be a temporary solution. However, it can help many projects, considering the different pilot plants, laboratory, and equipment at Quim. Hunting requires a capacity to know different Quim facilities and people, to be internally positively recognized, and to be able to convince the corporate and business units leadership to lend resources. The capacity to find resources and to borrow then, obviously, contributes to the continuity of the radical innovation projects.

However, this situation characterizes a dependence on the capacity of the pilot plants to support IF projects. It is not always possible to guarantee that innovation projects will be prioritized in this situation though they can be useful when the pilot plants are being underutilized and the innovation team can convince the BUs director to use them provisionally.

## **2. Borrowing resources by corporate leadership request to the current business units – the Quim case**

In the second approach, the IF needs to face external threats, economic crisis, C-level changes or other hostile internal phenomena forcing the firm to a more conservative resource allocation, more concentrated on the short-term plans of the BUs. The second approach is dependent on the corporate C-Level request to current business units to fund radical innovation projects.

The IF needs to try to change the resource allocation rules and cannot be dependent on personal C-Level intentions or vulnerable to external economic crisis and should develop at least one action and one integration role. One of the aims is to change the resources allocation rules to foster radical innovation projects.

At the same time, the innovation manager is taking on an integrator role: the orchestration of strategic alignment.

*“I take part in the three committees related to the financing of innovation projects. Throughout the year we have several strategic committees dealing with various issues. I'm getting inputs from the business units. So, so I'm adjusting my portfolio, adjusting my proposal [in this case it refers to the projects of the innovation portfolios of the IF]. There is the **regional committee** (the same business in one region, for example, Brazil), **the global committee** (same business, however in different regions, Brazil, USA or Europe), and that of the **CEO, VPs** (highest level). Recently (since the end of 2017), the CEO and VPS committee has met four times a year, the global as well, the regional six to eight times a year.”*

The C-Level at Quim has tried to change portfolio composition, and the firm's positioning includes the radical innovation portfolio projects, wanting to boost the higher uncertainty innovation projects at the highest hierarchical committee. Here the IF makes an important contribution. Quim does not know how to deal with this new composition of the innovation project portfolios. Quim knows that this new composition can be more appropriate for radical innovation projects, but the firm is still in the initial phase of discussion about how to operationalize it.

### **3. Borrowing additional resources from the Business Unit after previously receiving financial resources from the corporate level**

The case of CompAuto shows that the IF needs to overcome business units' internal resistance to lend additional resources to radical innovation projects. CompAuto predefined the resource allocation for radical innovation projects, but the IF must be able to borrow additional resources.

The data reveals two actions of the IF and three integrators in the CompAuto case.

The actions refer to the special protection adopted at CompAuto to protect radical innovation projects and the attempts to find an external partner. The special protection refers to particular follow-up meetings or the establishment of a specific cost center.

*“We have partnerships, in some cases with universities, equipment suppliers, but they are usually for projects with greater risks. Because we will not even acquire a piece of equipment when I do not know whether the concept will work. I make the concept development together with the external partner. If it is feasible, if you have an interesting customer, then you make an investment plan to deliver the product to the customer.”*

One integrator refers to hunting sponsors for funding the projects. The sponsors are necessary because even though CompAuto annually predefines the resources for radical innovation projects, through the year new resources are necessary. In this way, the IF hunts for sponsors to borrow additional resources from. As one of the IF managers said:

*“We came across an innovation that had a very interesting potential for CompAuto but did not fit into any business unit. As a result, we took it to the R&D director in Brazil, who was interested in the project. He made the decision to interface with the CompAuto board in Brazil to release extra resources for this specific exploration. For the approval of additional budgets. An important sponsor was necessary to explore an extra concept outside the business units.”*

Furthermore, the Global manager of new business platforms at CompAuto had to take on a project defender position involving the technical manager of the project, who is allocated in a business unit in Germany, and technical supports in Brazil (as appointed, for example, in the page 133).

The third integrator acts as a hunter for additional external resources. As the incubation technology portfolio manager stated, when borrowing additional resources in certain situations, it is important to demonstrate to the CompAuto directorship that additional internal resources are necessary; however, attempts are made to obtain part of

the resources from public funding, thereby minimizing the internal funding of a radical innovation project.

*“We did not have the necessary equipment here in Brazil. So we have a project with the support of BNDES, via Funtec. CompAuto funded 10% of the budget, and BNDES the rest. About R\$ 3 million. This will allow us to have access to analyses that we do not have here today. We can use this equipment in some other coating that we want to produce. The project had two stages. The first was the construction of a piece of equipment that made certain depositions (coatings) of the material, which was made by the incubated company. After this equipment was ready (second stage), it was installed in the university, and now they are producing some samples to see if we can find some concept that has the characteristics that we need. It is a large, time-consuming project involving two external partners and supported by the BNDES.”*

The IF borrows a part of the resources internally; however, another part needs to be found externally. In this case, without the external public support, the project should be aborted, as the manager of the incubation portfolio announced, *“If we had to do it alone, we wouldn't do it.”*

#### **4. Borrowing additional resources from the corporate level, after previously receiving resources from them**

The fourth borrowing approach points to additional actions and integrators' roles. Similar to CompAuto, there is an annual predefinition of the resources for radical innovation projects; however, the IF has to borrow more resources. But in the Pharm Case, the struggle is to convince the corporate decision makers. This case demonstrates three actions of the IF and one integrator.

One action of the IF is that of incorporating the lessons learned. The IF needs to present the radical innovation projects to the innovation committee of the firm to borrow additional resources. This committee is comprised of different directors, such as those from sales, purchasing, marketing, radical innovation, financing, and human resources. A comment from the IF Pharm team highlights this aspect.

*“When a project needs to be finished, we finalize by informing the innovation committee. We have to finish it very well as it will not be restarted. We always take to the board the lessons learned. In the innovation committee, we have to talk about why the project ends and, above all, what lessons have been learned.”*

As pointed out before, the solution implemented refers to three different aspects:

- accessible communication to all Pharm directors, *“Our language was very technical”*,
- regularity of the committee meetings (monthly meetings), *“We have a lot of meetings. So decision-makers tend to understand radical innovation projects more clearly. This helps in their decision-making”*,
- efforts to define criteria for supporting the decision makers at Pharm. *“At the moment, we are developing a tool to better explain to innovation committees, explaining the reasons for choosing one project and not another”*.

Another action is the alignment between the market prospection data, from the commercial and market department, with the technology drivers from the annual strategic planning. This practice is guided by one member of the IF and helps to avoid this situation described by one Pharm manager:

*“Three or four years ago the following situation was very common here. I start to develop a project without involving Marketing, and when I start to involve them, they said, ‘I don’t need this type of product anymore’. The involvement of these areas becomes very important. That’s why we have this specific pre-validation meeting with Marketing.”*

The third action is the flexible use of the resources and the capacity of the IF to foster non-regular interaction with the laboratories manager.

*“Within the R\$2 million there is a part that is destined for prototypes. This is meant for me to spend as I please. ‘At my leisure’ (...) If I cannot do everything I need within the R\$2 million, I have to leave it for the next year.”*

The Integration Manager takes on the integrator of the IF and is responsible for aligning the information from the different organizational functions and the C-level with the radical innovation nucleus and for guiding all the internal alignment to feed the discovery activities of radical innovation projects. As he says:

*“For the cases of the projects in the discovery phase, I go deep into the technical evaluation. I am already involved in other areas of the company such as analytical and pharmacotechnical development, and I go further into the scientific and technical documentation, and I also check with the clinical research personnel because it’s important to understand whether there are any restrictions about patents. If I have to discard some pharmaceutical formula, I talk to the medical*

*staff to see if there are any restrictions (for example, in the case of drugs prescribed by a psychiatrist I have to think of drugs that can be broken down — the film-coated ones cannot)”.*

Other managers of the IFs refer to the integrator manager as: “the one who puts the wheels on our molecules so they can roll”.

### 5.6. Propositions Analysis and extended conceptual model

The research analyzed three propositions:

**P.1. The integration of IF to borrow resources is different, when it borrows resources from the current business units, on one hand, and from the corporate level, on the other.**

**P.2. Instead of the prior destination of resources for radical innovation projects, or merely the existence of product champions and the high organizational level support, IF need to be able to struggle to borrow resources.**

**P.3. The integration mechanisms, as appointed by the classics authors, are essential, but they need to be used by IF to face the struggles to borrow resources.**

The research data confirmed all the propositions. Table 25 highlights the evidence which confirms the propositions.

**Table 25 - Overview of the proposition validation**

| <b>Proposition</b> | <b>Confirmed?</b> | <b>Evidences</b>   |
|--------------------|-------------------|--|
| <b>P1</b>          | Yes               | According to the three cases, emerged different characteristics related to borrowing resource for radical innovation projects by IF. The integration of IF to borrow resources is different, when it borrows resources from the current business units and when it borrows from the corporate level. |
| <b>P2</b>          | Yes               | The cross analysis reveals four borrowing research approaches, which generate specific side effect and barriers, which demands specific struggles.   |

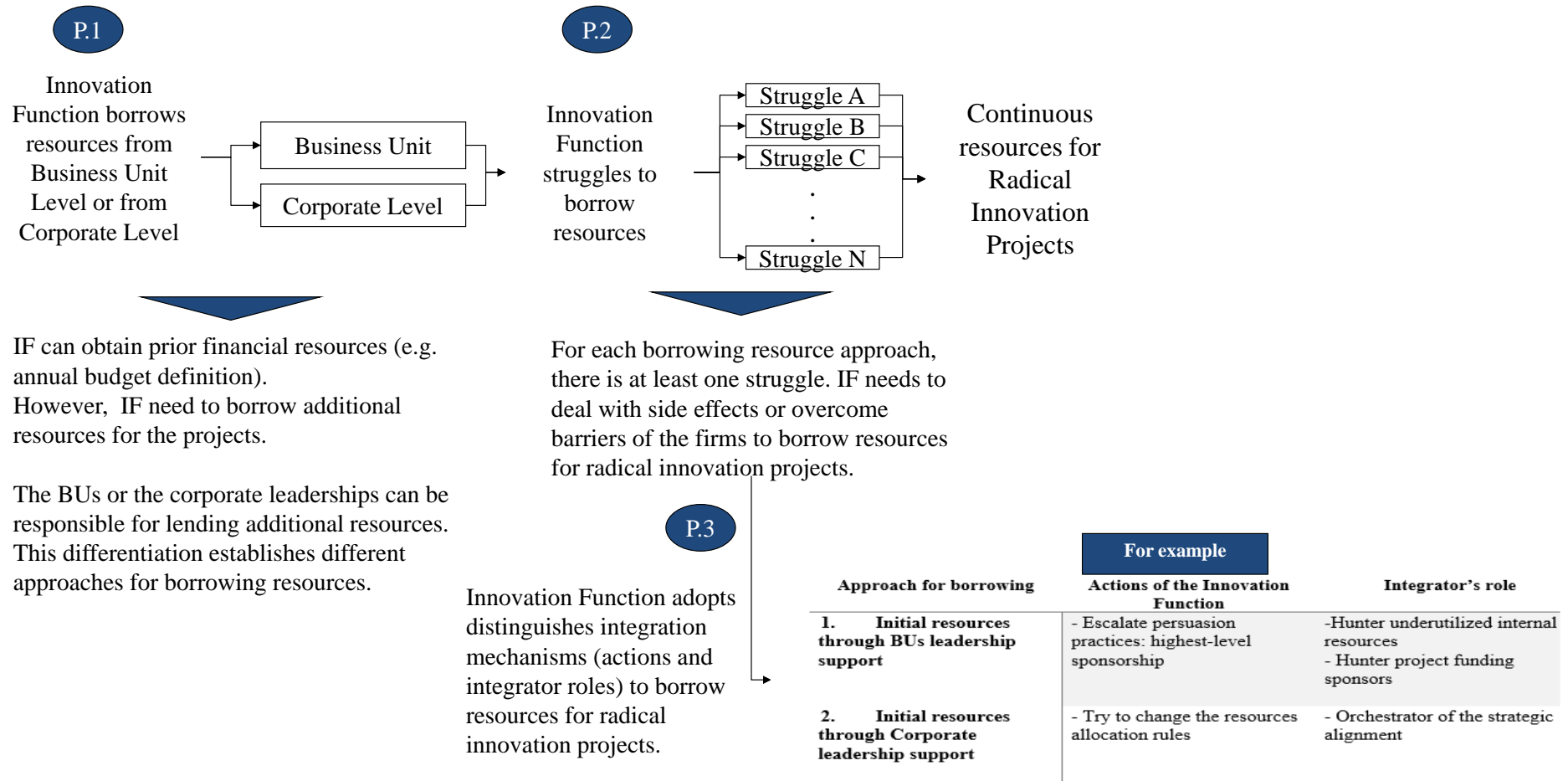
|           |     |   |
|-----------|-----|---|
| <b>P3</b> | Yes | <p>As appointed at chapter 02 - perspectives from revisiting the classic authors -, we consider that integration practices mean the establishment of mechanisms to coordinate the activities within the established firm between different organizational functions, business units or corporate level, in order to achieve the aims of the IF.</p> <p>The data from the cases show that these integration mechanisms can be focused on two aspects: i) IF actions and ii) integrators. As noted on table 24 these IF action and integrators' role are necessary to IF to face the struggles, according to each approach.</p> |
|-----------|-----|---|

Source: The author

In order to synthesize the discussion, based on the conceptual model shown in Chapter 3 (Figure 14) and the results of this dissertation, an extended conceptual model is proposed in the following figure to confirm the three propositions. This extended conceptual model, as indicated in Figure 20, sum up the data analysis from the research field (discussed in Chapters 3 and 4) and the analysis of the propositions extracted from the literature review.

**Figure 20 - Extended Conceptual Model**

How do firms integrate the innovation function to borrow resources for radical innovation projects?



Source: The author



## 6. Conclusions

This dissertation has one general objective and three specific objectives. The general objective is to explain how the IF is integrated within the parent firm to borrow resources. The explanation found through the case studies is that there is not just one way to integrate and the integration can vary within one firm (e.g., Quim case reveals two approaches to borrow resources). Following the assumption of the contingency theory, “*there is no one best way to organize*” (Donaldson, 2006), different alternatives to integration were identified. This differentiation also establishes four different approaches to borrowing resources, which require different integration efforts from the IF.

Furthermore, to offer an in-depth analysis of integration, this dissertation discovered that for each approach to borrowing resources there are the struggles of the IF. This dissertation shows four struggles. Firstly, there is the struggle of the IF not to become a hostage to the short-term interest, to the current markets, or existing product domains (Quim case). Secondly, there is the struggle of the IF against vulnerabilities to counterforces such as external threats, economic crisis, C-level changes in support, or hostile internal external phenomena, to borrow resources (Quim case). Thirdly, there is the struggle of the IF to go beyond the earlier predefined resources for projects, by overcoming the internal resistance of business units (CompAuto case) and, finally, there is the struggle to get the corporate decision makers to provide additional resources (Pharm case).

The cross-case analysis highlights that the IF adopts different integration mechanisms to borrow resources for radical innovation projects according to the situation. The data from the cases show that these integration mechanisms can be focused on two aspects: i) the actions of the IF, and ii) integrators. This dissertation assumed that the IF, as an organizational function, needs to be separated from but also integrated into the parent firm. In this way, this dissertation offered a granular perspective on how integration might take place. The integration was analyzed as a capability which should, for example, prevent the rejection of the resources for radical innovation projects.

This dissertation is based on the contribution from classic authors, especially Lawrence and Lorsch. As noted by Tushman (2017), despite the temporal distance between the contributions of this classic paper and the present day, organizational

integration continues to interest business scholars. The current literature (e.g., Raisch et al., 2009; O'Reilly & Tushman, 2013; Birkinshaw, Zimmermann, & Raisch, 2016) has cited Lawrence and Lorsch (1967) as the “fathers” of the theory of organizational integration.

We observed that the Lawrence and Lorsch (1967) theoretical anchorage opens up an important research avenue. The current literature, however, does not offer a profound analysis of integration for the organizational function to borrow resources for radical innovation projects. Therefore, the findings allow us to achieve three specific objectives: i) identify the integration practices of the IF to borrow resources; ii) explain how the different integration practices contribute to borrowing resources; iii) establish categories of borrowing resources by the IF.

Besides, the theoretical contributions from this dissertation can be synthesized as follows.

The case studies demonstrate that the IF approach to borrowing resources cannot be seen as a way to accumulate resources. O'Connor et al. (2008) state that instead of accumulating resources, the IF needs to be able to configure the resources in advantageous ways. This dissertation advanced this argument in finding that this advantage can be generated by the efforts of the IF to deal with or avoid the side effects of each approach to borrow resources. For example, the first approach requires efforts from the IF to avoid becoming hostage to the short-term interest or the current markets or project domains. It needs, as seen in the case studies, different actions carried out by the IF and integrators. The same idea is observed in all the approaches to borrowing resources.

As a consequence, the second theoretical contribution of this dissertation emerged. Jansen et al. (2009) and Tushman and O'Reilly (1996) pointed out that the top management teams (e.g., senior teams) ensure the necessary integration across ongoing mainstream operations and exploratory organizational forms. The findings of this dissertation reveal that more than the top management support is essential, the actions and integrators' roles complement this support.

The findings of the dissertation thus filled in gaps in many research proposals. Chen and Kannan-Narasimhan, (2015) consider that existing research does not tell us the operational nuances of how to integrate intra-firm units to boost radical innovation project

development as the discussion has only outlined a general picture of what elements the integration process entails. Cantarello, Martini and Nosella, (2012) reinforce the importance of qualitative studies at the micro level, which would allow organizational integration within innovative established firms. Turner, Swart, and Maylor (2013) point out that little work has been done on organizational integration to boost the development of radical innovation projects. Furthermore, O'Connor (2012) believes that more research needs to be done to understand how the IF should be resourced. O'Reilly and Tushman (2013) call for more insights into the nature of managerial capability to achieve ambidexterity, as well as more inductive research on how leaders may orchestrate the allocation (and reallocation) of resources between old and new business domains.

Despite these contributions, this dissertation adopted an inductive study using multiple case research design. This methodology focus was suitable because it is a type of study focused on objects of analysis that are contemporary phenomena and difficult to study in isolation, providing a deeper understanding of the phenomena. However, findings from case studies are limited. As pointed out by Eisenhardt (1989), Voss, Tsikriktsis and Frohlich (2002), and Yin (1994), the results discussed here are valid for the context analyzed. The generalization of the findings needs to be circumscribed to similar contexts.

This dissertation focused on established industrial firms recognized as innovators and operating in Brazil. This focus influenced the non-random case selection. In order to broaden the sample, we extended the definition of radical innovation. This study assumed that this would not be problematic and would be closer to the reality of the Brazilian firms, without moving away from the essence of the research question. Future studies might try to answer the research question of this dissertation in established firms from different regions or countries. An initial hypothesis is that approaches 1 and 2 could be more likely to occur in countries such as Brazil, with the predominance of commoditized or tropicalized products and/or with a lower degree of technological disruption or creation of global markets. Besides, although we were able to find different approaches to borrowing resources, struggles of the IF and its integration practices, it is not clear whether these findings are similar or not by comparing innovative firms in a specific innovative industrial sector. Could the IF in the Pharm sector, IT, or service firms show similar practices, approaches, and struggles? Can the differences be explained by the

different types of industrial sectors or by the different kinds of projects? Future studies should examine whether the integration of the IF can be applied to other contexts.

Furthermore, O'Connor et al. (2008) highlight the importance of guaranteeing specific perennial technology resources (e.g., laboratories), human and financial resources for each of the three capabilities (DNA Model – see Figure 3, page 30): discovery, incubation, and acceleration. Future research could exploit the differences between the needs for the IF to borrow resources for discovering, incubating and accelerating radical innovation projects.

## References

- Agostini, L., Nosella, A., & Filippini, R. (2016). Users and radical innovation performance: the moderating role of the organisational context. *Technology Analysis & Strategic Management*, 28(7), 798-810.
- Aloini, D., Bessant, J., Martini, A., & Von Stamm, B. (2013). Search practices for discontinuous innovation: scale development and construct validation. *Technology Analysis & Strategic Management*, 25(10), 1139-1160.
- Andriopoulos, C., & Lewis, M. W. (2009). Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation. *Organization Science*, 20(4), 696-717.
- Arrighi, P. A., Le Masson, P., & Weil, B. (2015). Managing radical innovation as an innovative design process: generative constraints and cumulative sets of rules. *Creativity and Innovation Management*, 24(3), 373-390.
- Bagno, R. B. (2014). *Inovação como uma nova função organizacional: caracterização a partir da experiência de empresas industriais de grande porte no Brasil* (Doctoral dissertation, Universidade de São Paulo).
- Bagno, R. B., Salerno, M. S., & Dias, A. V. C. (2017). Innovation as a new organizational function: evidence and characterization from large industrial companies in Brazil. *Production*, 27.
- Baker, W. E., & Sinkula, J. M. (2007). Does market orientation facilitate balanced innovation programs? An organizational learning perspective. *Journal of Product Innovation Management*, 24(4), 316-334.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.
- Benner, M. J., & Tushman, M. L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review*, 28(2), 238-256.
- Benner, M. J., & Tushman, M. L. (2015). Reflections on the 2013 Decade Award—“Exploitation, exploration, and process management: The productivity dilemma revisited” ten years later. *Academy of Management Review*, 40(4), 497-514.
- Berchicci, L., & Tucci, C. L. (2010). There is more to market learning than gathering good information: the role of shared team values in radical product definition. *Journal of Product Innovation Management*, 27(7), 972-990.
- Bessant, J., Öberg, C., & Trifilova, A. (2014). Framing problems in radical innovation. *Industrial Marketing Management*, 43(8), 1284-1292.

Bessant, J. (2008). Dealing with discontinuous innovation: the European experience. *International Journal of Technology Management*, 42(1-2), 36-50.

Birkinshaw, J., Zimmermann, A., & Raisch, S. (2016). How do firms adapt to discontinuous change? Bridging the dynamic capabilities and ambidexterity perspectives. *California Management Review*, 58(4), 36-58.

Bohlmann, J. D., Spanjol, J., Qualls, W. J., & Rosa, J. A. (2013). The interplay of customer and product innovation dynamics: an exploratory study. *Journal of Product Innovation Management*, 30(2), 228-244.

Bowman, C., & Ambrosini, V. (2003). How the resource-based and the dynamic capability views of the firm inform corporate-level strategy. *British Journal of Management*, 14(4), 289-303.

Burgelman, R. A., & Valikangas, L. (2005). Managing internal corporate venturing cycles: companies too often vacillate in their commitment to internal corporate venturing activities, leading to less than optimal outcomes. Executives need to better understand--and manage--the factors that drive cyclicity in internal corporate venturing. *MIT Sloan Management Review*, 46(4), 26-35.

Burgers, J. H., Jansen, J. J., Van den Bosch, F. A., & Volberda, H. W. (2009). Structural differentiation and corporate venturing: The moderating role of formal and informal integration mechanisms. *Journal of Business Venturing*, 24(3), 206-220.

Cantarello, S., Martini, A., & Nosella, A. (2012). A multi-level model for organizational ambidexterity in the search phase of the innovation process. *Creativity and Innovation Management*, 21(1), 28-48.

Carvalho, M., Fleury, A., & Lopes, A. P. (2013). An overview of the literature on technology roadmapping (TRM): Contributions and trends. *Technological Forecasting and Social Change*, 80(7), 1418-1437.

Chang, Y. C., Chang, H. T., Chi, H. R., Chen, M. H., & Deng, L. L. (2012). How do established firms improve radical innovation performance? The organizational capabilities view. *Technovation*, 32(7-8), 441-451.

Chen, R. R., & Kannan-Narasimhan, R. P. (2015). Formal integration archetypes in ambidextrous organizations. *R&D Management*, 45(3), 267-286.

Chesbrough, H. (2006). Open innovation: a new paradigm for understanding industrial innovation. *Open innovation: Researching a new paradigm*, 400, 0-19.

Cho, S. Y., & Kim, S. K. (2017). Horizon problem and firm innovation: The influence of CEO career horizon, exploitation and exploration on breakthrough innovations. *Research Policy*, 46(10), 1801-1809.

Christensen, C. M., & Christensen, C. M. (2003). *The innovator's dilemma: The revolutionary book that will change the way you do business* (p. 320). New York, NY: HarperBusiness Essentials.

- Christensen, C. M., & Bower, J. L. (1996). Customer power, strategic investment, and the failure of leading firms. *Strategic Management Journal*, 17(3), 197-218.
- Clark, K. B., & Wheelwright, S. C. (1993). *Managing new product and process development: texts and cases*, New York, NY: The Free Press
- Cooper, R. G. (2001). *Winning at New Products: Accelerating the Process from Idea to Launch*, Reading, MA: Addison Wesley Publishing, 1993.
- Culnan, M. J., O'Reilly III, C. A., & Chatman, J. A. (1990). Intellectual structure of research in organizational behavior, 1972–1984: A cocitation analysis. *Journal of the American Society for Information Science*, 41(6), 453-458.
- Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, 34(3), 555-590.
- Damanpour, F., & Gopalakrishnan, S. (1998). Theories of organizational structure and innovation adoption: the role of environmental change. *Journal of Engineering and Technology Management*, 15(1), 1-24.
- Donaldson, L. (1999). Teoria da contingência estrutural. *Handbook de Estudos Organizacionais*, 1, 105-133.
- Dougherty, D., & Hardy, C. (1996). Sustained product innovation in large, mature organizations: Overcoming innovation-to-organization problems. *Academy of Management Journal*, 39(5), 1120-1153.
- Duncan, R. B. (1976). The ambidextrous organization: Designing dual structures for innovation. *The Management of Organization*, 1, 167-188.
- Eisenhardt, K. (1989). Building theories from case study research. *Academy of Management Review*, 4, (4), 532-550.
- Felekoglu, B., & Moultrie, J. (2014). Top management involvement in new product development: A review and synthesis. *Journal of Product Innovation Management*, 31(1), 159-175.
- Fleury, A. (2010). Planejamento do projeto de pesquisa e definição do modelo teórico. *Metodologia de pesquisa em engenharia de produção e gestão de operações*. Rio de Janeiro: Elsevier, 33-44.
- Galbraith, J. R. (1994). *Competing with flexible lateral organizations*. Reading, MA: Addison-Wesley.
- Galbraith, J., Downey, D., & Kates, A. (2001). *Designing dynamic organizations: A hands-on guide for leaders at all levels*. Amacom. Div American Mgmt Assn.

Garcia, R., & Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: a literature review. *Journal of Product Innovation Management*, 19(2), 110-132.

Gassmann, O., Widenmayer, B., & Zeschky, M. (2012). Implementing radical innovation in the business: the role of transition modes in large firms. *R&D Management*, 42(2), 120-132.

Gilbert, C. G. (2002). *Beyond resource allocation: towards a process model of response to disruptive change*. Division of Research, Harvard Business School. Retrived, August 4, 2018, from [http://www.hbs.edu/faculty/Publication%20Files/03-018\\_04b19766-2247-46f7-89d6-da77529886f1.pdf](http://www.hbs.edu/faculty/Publication%20Files/03-018_04b19766-2247-46f7-89d6-da77529886f1.pdf) -

Govindarajan, V., & Trimble, C. (2005). Organizational DNA for strategic innovation. *California Management Review*, 47(3), 47-76.

Graetz, F., & Smith, A. C. (2009). Duality theory and organizing forms in change management. *Journal of Change Management*, 9(1), 9-25.

Griffin, A., Price, R. L., Vojak, B. A., & Hoffman, N. (2014). Serial Innovators' processes: How they overcome barriers to creating radical innovations. *Industrial Marketing Management*, 43(8), 1362-1371.

Gupta, A. K., & Govindarajan, V. (1984). Business unit strategy, managerial characteristics, and business unit effectiveness at strategy implementation. *Academy of Management Journal*, 27(1), 25-41.

He, Z. L., & Wong, P. K. (2004). Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science*, 15(4), 481-494.

Heracleous, L., Papachroni, A., Andriopoulos, C., & Gotsi, M. (2017). Structural ambidexterity and competency traps: Insights from Xerox PARC. *Technological Forecasting and Social Change*, 117, 327-338.

Hill, S. A., & Birkinshaw, J. (2014). Ambidexterity and survival in corporate venture units. *Journal of Management*, 40(7), 1899-1931.

Homrich, A. S., Galvao, G., Abadia, L. G., & Carvalho, M. M. (2018). The circular economy umbrella: Trends and gaps on integrating pathways. *Journal of Cleaner Production*, 175, 525-543.

Iansiti, M., McFarlan, F. W., & Westerman, G. (2003). Leveraging the incumbent's advantage. *MIT Sloan Management Review*, 44(4), 58.

Jansen, J. J., Tempelaar, M. P., Van den Bosch, F. A., & Volberda, H. W. (2009). Structural differentiation and ambidexterity: The mediating role of integration mechanisms. *Organization Science*, 20(4), 797-811.

Kim, P. H., Kotha, R. R., & Fourné, S. (2018, July). Taking Leaps of Faith: Evaluation Criteria and Resource Commitments for Breakthrough Inventions. In *Academy of*



- Management Proceedings* (Vol. 2018, No. 1, p. 10219). Briarcliff Manor, NY 10510: Academy of Management.
- Kelley, D. J., Peters, L., & O'Connor, G. C. (2009). Intra-organizational networking for innovation-based corporate entrepreneurship. *Journal of Business Venturing*, 24(3), 221-235.
- Kelley, D. (2009). Adaptation and organizational connectedness in corporate radical innovation programs. *Journal of Product Innovation Management*, 26(5), 487-501.
- Kelley, D. J., O'Connor, G. C., Neck, H., & Peters, L. (2011). Building an organizational capability for radical innovation: The direct managerial role. *Journal of Engineering and Technology Management*, 28(4), 249-267.
- Lawrence, P. R., & Lorsch, J. W. (1967). Differentiation and integration in complex organizations. *Administrative Science Quarterly*, 1-47.
- Lawrence, P. R., & Lorsch, J. W. (1973). *As empresas eo ambiente: diferenciação e integração administrativas*. Vozes.
- Leifer, R., O'Connor, G. C., & Rice, M. (2001). Implementing radical innovation in mature firms: The role of hubs. *Academy of Management Perspectives*, 15(3), 102-113.
- Leifer, R., McDermott, C. M., O'Connor, G. C., Peters, L. S., Rice, M. P., & Veryzer Jr, R. W. (2000). *Radical innovation: How mature companies can outsmart upstarts*. Harvard Business Press.
- Lettice, F., & Thomond, P. (2008). Allocating resources to disruptive innovation projects: challenging mental models and overcoming management resistance. *International Journal of Technology Management*, 44(1-2), 140-159.
- Maine, E. (2008). Radical innovation through internal corporate venturing: Degussa's commercialization of nanomaterials. *R&D Management*, 38(4), 359-371.
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71-87.
- Markham, S. K., Ward, S. J., Aiman-Smith, L., & Kingon, A. I. (2010). The valley of death as context for role theory in product innovation. *Journal of Product Innovation Management*, 27(3), 402-417.
- Martin, J. A., & Eisenhardt, K. M. (2010). Rewiring: Cross-business-unit collaborations in multibusiness organizations. *Academy of Management Journal*, 53(2), 265-301.
- McDermott, C. M., & O'Connor, G. C. (2002). Managing radical innovation: an overview of emergent strategy issues. *Journal of Product Innovation Management*, 19(6), 424-438.
- Mintzberg, H., Lampel, J., Quinn, J. B., & Ghoshal, S., (2006). *O processo da estratégia: conceitos, contextos e casos selecionados*. Porto Alegre. RS: Bookman.

- O'Connor, G. C., & DeMartino, R. (2006). Organizing for radical innovation: An exploratory study of the structural aspects of RI management systems in large established firms. *Journal of Product Innovation Management*, 23(6), 475-497.
- O'Connor, G. C. (2008). Major innovation as a dynamic capability: A systems approach. *Journal of Product Innovation Management*, 25(4), 313-330.
- O'Connor, G. C., Leifer, R., Paulson, A., & Peters, L. (2008). *Grabbing lightning: Building a capability for breakthrough innovation*, John Wiley & Sons, 2008.
- O'Connor, G. C. (2012). Innovation: from process to function. *Journal of Product Innovation Management*, 29(3), 361-363.
- O'Connor, G. C., & Rice, M. P. (2013). A comprehensive model of uncertainty associated with radical innovation. *Journal of Product Innovation Management*, 30, 2-18.
- O'Connor, G. C., Corbett, A. C., & Peters, L. S. (2018). *Beyond the champion: institutionalizing innovation through people*. Stanford University Press.
- O'Reilly 3rd, C. A., & Tushman, M. L. (2004). The ambidextrous organization. *Harvard Business Review*, 82(4), 74.
- O'Reilly III, C. A., & Tushman, M. L. (2008). Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. *Research in Organizational Behavior*, 28, 185-206.
- O'Reilly III, C. A., & Tushman, M. L. (2011). Organizational ambidexterity in action: How managers explore and exploit. *California Management Review*, 53(4), 5-22.
- O'Reilly III, C. A., & Tushman, M. L. (2013). Organizational ambidexterity: Past, present, and future. *Academy of Management Perspectives*, 27(4), 324-338.
- O'Reilly III, C. A., & Tushman, M. L. (2016). *Lead and disrupt: How to solve the innovator's dilemma*. Stanford University Press.
- Quinn, J. B. (1987). Managing Innovation: Controlled Chaos: *Harvard Business Review*, 2(4), 485.
- Pashaei, S., & Olhager, J. (2015). Product architecture and supply chain design: a systematic review and research agenda. *Supply Chain Management: An International Journal*, 20(1), 98-112.
- Raisch, S. (2008). Balanced structures: designing organizations for profitable growth. *Long Range Planning*, 41(5), 483-508.
- Raisch, S., & Birkinshaw, J. (2008). Organizational ambidexterity: Antecedents, outcomes, and moderators. *Journal of Management*, 34(3), 375-409.
- Raisch, S., Birkinshaw, J., Probst, G., & Tushman, M. L. (2009). Organizational ambidexterity: Balancing exploitation and exploration for sustained performance. *Organization Science*, 20(4), 685-695.
- Salerno, M. S. (2009). Reconfigurable organisation to cope with unpredictable goals. *International Journal of Production Economics*, 122(1), 419-428.

- Salerno, M. S., Gomes, L. A. V., O'Connor, G. C., & Peters, L. S. (2016). The innovation function: a formal definition and a proof of existence. *Work in progress*.
- Salerno, M. S., & Gomes, L. A. V. (2018). *Gestão da inovação mais radical*. Elsevier Brasil.
- Sandberg, B., & Aarikka-Stenroos, L. (2014). What makes it so difficult? A systematic review on barriers to radical innovation. *Industrial Marketing Management*, 43(8), 1293-1305.
- Silva, D. O. D. (2016). *Gestão de portfólio de projetos de inovação: análise das práticas adotadas por empresas industriais de grande porte* (Doctoral dissertation, Universidade de São Paulo).
- Silva, D. O.D., Bagno, R. B., & Salerno, M. S. (2014). Modelos para a gestão da inovação: revisão e análise da literatura. *Production*, 24(2), 477-490.
- Slater, S. F., Mohr, J. J., & Sengupta, S. (2014). Radical product innovation capability: Literature review, synthesis, and illustrative research propositions. *Journal of Product Innovation Management*, 31(3), 552-566.
- Taylor, A., & Helfat, C. E. (2009). Organizational linkages for surviving technological change: Complementary assets, middle management, and ambidexterity. *Organization Science*, 20(4), 718-739.
- Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15(6), 285-305.
- Teece, D. J. (2006). Reflections on “profiting from innovation”. *Research Policy*, 35(8), 1131-1146.
- Tripsas, M., & Gavetti, G. (2000). Capabilities, cognition, and inertia: Evidence from digital imaging. *Strategic Management Journal*, 21(10-11), 1147-1161.
- Tushman, M. L. (2017). Paul R. Lawrence: A career of rigor, relevance, and passion. *The Palgrave Handbook of Organizational Change Thinkers*, 1-11.
- Tushman, M.L., Smith, W. K., Wood, R. C., Westerman, G., & O'Reilly, C. (2010). Organizational designs and innovation streams. *Industrial and Corporate Change*, 19(5), 1331-1366.
- Tushman, M. L., & O'Reilly III, C. A. (1996). Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review*, 38(4), 8-29.
- Tushman, M. L. (1977). Special boundary roles in the innovation process. *Administrative Science Quarterly*, 587-605.
- Turner, N., Swart, J., & Maylor, H. (2013). Mechanisms for managing ambidexterity: A review and research agenda. *International Journal of Management Reviews*, 15(3), 317-332.

- Utterback, J. M., & Abernathy, W. J. (1975). A dynamic model of process and product innovation. *Omega*, 3(6), 639-656.
- Van Burg, E., de Jager, S., Reymen, I. M., & Cloudt, M. (2012). Design principles for corporate venture transition processes in established technology firms. *R&D Management*, 42(5), 455-472.
- Van Eck, N. J., & Waltman, L. (2016). VosViewer manual: manual for VosViewer version 1.6. 5. CWTS, Leiden *Google Scholar*.
- Veryzer Jr, R. W. (1998). Key factors affecting customer evaluation of discontinuous new products. *Journal of Product Innovation Management*, 15(2), 136-150.
- Volberda, H. W. (1999). *Building the flexible firm: How to remain competitive*. Oxford University Press, USA.
- Voss, C. T., Tsikriktsis, N., & Frohlich, M. (2002) Case research in operations management. *International Journal of Operations & Production Management*, 22(2), 195-219.
- Westerman, G., McFarlan, F. W., & Iansiti, M. (2006). Organization design and effectiveness over the innovation life cycle. *Organization Science*, 17(2), 230-238.
- Wilden, R., Hohberger, J., Devinney, T. M., & Lavie, D. (2018). Revisiting James March (1991): Whither exploration and exploitation? *Strategic Organization*, 16(3), 352-369.
- Yin, R. K. (1994). *Case study research and applications: Design and methods*. Newbury Park, Sage publications.

### Appendix 1 - Full spreadsheet of the 66 papers

| #  | Authors                                  | Title  | Journal  |
|----|--|--|--|
| 1  | Agostini and Moreno (2018)               | Exploration during turbulent times: an analysis of the relation between cooperation in innovation activities and radical innovation performance during the economic crisis | INDUSTRIAL AND CORPORATE CHANGE                |
| 2  | Kodama (2018)                            | Boundaries innovation through knowledge convergence-developing triad strategic communities   | TECHNOLOGY ANALYSIS & STRATEGIC MANAGEMENT     |
| 3  | Cho and Kim (2017)                       | Horizon problem and firm innovation: The influence of CEO career horizon, exploitation and exploration on breakthrough innovations   | RESEARCH POLICY                                |
| 4  | Zhang et al. (2017)                      | Configurations of Innovations across Domains: An Organizational Ambidexterity View   | JOURNAL OF PRODUCT INNOVATION MANAGEMENT       |
| 5  | Kodama (2017)                            | Developing strategic innovation in large corporationsThe dynamic capability view of the firm   | KNOWLEDGE AND PROCESS MANAGEMENT               |
| 6  | Zadeh et al. (2017)                      | Challenges and difficulties of technology commercialization - a mixed-methods study of an industrial development organization  | MANAGEMENT RESEARCH REVIEW                     |
| 7  | Gao, Cheng and Feng (2017)               | How does market learning affect radical innovation? The moderation roles of horizontal ties and vertical ties  | JOURNAL OF BUSINESS & INDUSTRIAL MARKETING     |
| 8  | Dong et al. (2017)                       | How Central Is Too Central? Organizing Interorganizational Collaboration Networks for Breakthrough Innovation  | JOURNAL OF PRODUCT INNOVATION MANAGEMENT       |
| 9  | Hooge, Bejean, and Arnoux (2016)         | ORGANISING FOR RADICAL INNOVATION: THE BENEFITS OF THE INTERPLAY BETWEEN COGNITIVE AND ORGANISATIONAL PROCESSES IN KCP WORKSHOPS   | INTERNATIONAL JOURNAL OF INNOVATION MANAGEMENT |
| 10 | Agostini, Nosella and Filippini (2016)   | Users and radical innovation performance: the moderating role of the organisational context  | TECHNOLOGY ANALYSIS & STRATEGIC MANAGEMENT     |
| 11 | Birkinshaw, Zimmermann and Raisch (2016) | How Do Firms Adapt to Discontinuous Change? Bridging the Dynamic Capabilities and Ambidexterity Perspectives   | CALIFORNIA MANAGEMENT REVIEW                   |
| 12 | Arrighi, Masson and Weil (2015)          | Managing Radical Innovation as an Innovative Design Process: Generative Constraints and Cumulative Sets of Rules   | CREATIVITY AND INNOVATION MANAGEMENT           |
| 13 | Guttel, Konlechner and Trede (2015)      | Standardized individuality versus individualized standardization: the role of the context in structurally ambidextrous organizations                                       | REVIEW OF MANAGERIAL SCIENCE                   |

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| 14 | Bicen and Johnson (2014)             | How do firms innovate with limited resources in turbulent markets?  | INNOVATION-MANAGEMENT POLICY & PRACTICE     |
| 15 | Bessant, Oberg, and Trifilova (2014) | Framing problems in radical innovation  | INDUSTRIAL MARKETING MANAGEMENT             |
| 16 | Hienerth, Lettl, and Keinz (2014)    | Synergies among Producer Firms, Lead Users, and User Communities: The Case of the LEGO Producer-User Ecosystem        | JOURNAL OF PRODUCT INNOVATION MANAGEMENT    |
| 17 | Chen and Kannan-Narasimhan (2015)    | Formal integration archetypes in ambidextrous organizations   | R&D MANAGEMENT                              |
| 18 | Griffin et al. (2014)                | Serial Innovators' processes: How they overcome barriers to creating radical innovations                              | INDUSTRIAL MARKETING MANAGEMENT             |
| 19 | Slater, Mohr and Sengupta (2014)     | Radical Product Innovation Capability: Literature Review, Synthesis, and Illustrative Research Propositions           | JOURNAL OF PRODUCT INNOVATION MANAGEMENT    |
| 20 | Aloini et al. (2013)                 | Search practices for discontinuous innovation: scale development and construct validation                             | TECHNOLOGY ANALYSIS & STRATEGIC MANAGEMENT  |
| 21 | Turner, Swart and Maylor (2013)      | Mechanisms for Managing Ambidexterity: A Review and Research Agenda   | INTERNATIONAL JOURNAL OF MANAGEMENT REVIEWS |
| 22 | Robeson and O'Connor (2013)          | Boards of Directors, Innovation, and Performance: An Exploration at Multiple Levels                                   | JOURNAL OF PRODUCT INNOVATION MANAGEMENT    |
| 23 | O'Connor and Rice (2013)             | New Market Creation for Breakthrough Innovations: Enabling and Constraining Mechanisms                                | JOURNAL OF PRODUCT INNOVATION MANAGEMENT    |
| 24 | Bohlmann et al. (2013)               | The Interplay of Customer and Product Innovation Dynamics: An Exploratory Study                                       | JOURNAL OF PRODUCT INNOVATION MANAGEMENT    |
| 25 | O'Connor and Rice (2013)             | A Comprehensive Model of Uncertainty Associated with Radical Innovation   | JOURNAL OF PRODUCT INNOVATION MANAGEMENT    |
| 26 | Durisin and Todorova (2012)          | A Study of the Performativity of the "Ambidextrous Organizations" Theory: Neither Lost in nor Lost before Translation | JOURNAL OF PRODUCT INNOVATION MANAGEMENT    |

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| 27 | Burg et al. (2012)                       | Design principles for corporate venture transition processes in established technology firms  | R&D MANAGEMENT                                 |
| 28 | Chang et al. (2012)                      | How do established firms improve radical innovation performance? The organizational capabilities view                                   | TECHNOVATION                                   |
| 29 | Gassmann, Widenmayer, and Zeschky (2012) | Implementing radical innovation in the business: the role of transition modes in large firms  | R&D MANAGEMENT                                 |
| 30 | Zhou and Li (2012)                       | How knowledge affects radical innovation: Knowledge base, market knowledge acquisition, and internal knowledge sharing                  | Strategic Management Journal                   |
| 31 | Cantarello, Martini and Nosella (2012)   | A Multi-Level Model for organizational Ambidexterity in the search phase of the innovation Process                                      | CREATIVITY AND INNOVATION MANAGEMENT           |
| 32 | Bessant et al. (2011)                    | Selection strategies for discontinuous innovation   | INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT |
| 33 | Berchicci and Tucci (2010)               | There Is More to Market Learning than Gathering Good Information: The Role of Shared Team Values in Radical Product Definition          | JOURNAL OF PRODUCT INNOVATION MANAGEMENT       |
| 34 | Tushman et al. (2010)                    | Organizational designs and innovation streams   | INDUSTRIAL AND CORPORATE CHANGE                |
| 35 | Visser et al. (2010)                     | Structural ambidexterity in NPD processes: A firm-level assessment of the impact of differentiated structures on innovation performance | TECHNOVATION                                   |
| 36 | Andriopoulos and Lewis (2010)            | Managing innovation paradoxes: ambidexterity lessons from leading product design companies  | LONG RANGE PLANNING                            |
| 37 | Kauppila (2010)                          | Creating ambidexterity by integrating and balancing structurally separate interorganizational partnerships                              | Strategic Organization                         |
| 38 | Kelley (2009)                            | Adaptation and Organizational Connectedness in Corporate Radical Innovation Programs  | JOURNAL OF PRODUCT INNOVATION MANAGEMENT       |
| 39 | Cotterman et al. (2009)                  | ALIGNING MARKETING AND TECHNOLOGY TO DRIVE INNOVATION   | RESEARCH-TECHNOLOGY MANAGEMENT                 |
| 40 | Andriopoulos and Lewis (2009)            | Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation                                    | ORGANIZATION SCIENCE                           |

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| 41 | Raisch et al. (2009)               | Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance  | ORGANIZATION SCIENCE                           |
| 42 | Taylor and Helfat (2009)           | Organizational Linkages for Surviving Technological Change: Complementary Assets, Middle Management, and Ambidexterity  | ORGANIZATION SCIENCE                           |
| 43 | Kelley, Peters and O'Connor (2009) | Intra-organizational networking for innovation-based corporate entrepreneurship   | Journal of Business Venturing                  |
| 44 | Burgers et al. (2009)              | Structural differentiation and corporate venturing: The moderating role of formal and informal integration mechanisms   | Journal of Business Venturing                  |
| 45 | Carmeli and Halevi (2009)          | How top management team behavioral integration and behavioral complexity enable organizational ambidexterity: The moderating role of contextual ambidexterity | The Leadership Quarterly                       |
| 46 | Jansen et al. (2009)               | Structural differentiation and ambidexterity: The mediating role of integration mechanisms  | ORGANIZATION SCIENCE                           |
| 47 | Mom, Bosch and Volberda (2009)     | Understanding Variation in Managers' Ambidexterity: Investigating Direct and Interaction Effects of Formal Structural and Personal Coordination Mechanisms    | ORGANIZATION SCIENCE                           |
| 48 | Maine (2008)                       | Radical innovation through internal corporate venturing: Degussa's commercialization of nanomaterials   | R&D MANAGEMENT                                 |
| 49 | O'Connor (2008)                    | Major innovation as a dynamic capability: A systems approach  | JOURNAL OF PRODUCT INNOVATION MANAGEMENT       |
| 50 | Magnusson, M; Martini, A           | Dual organisational capabilities: from theory to practice - the next challenge for continuous innovation  | INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT |
| 51 | Soosay and Hyland (2008)           | Exploration and exploitation: the interplay between knowledge and continuous innovation   | INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT |
| 52 | Cabrales et al. (2008)             | Managing functional diversity, risk taking and incentives for teams to achieve radical innovations  | R&D MANAGEMENT                                 |
| 53 | Raisch (2008)                      | Balanced Structures: Designing Organizations for Profitable Growth  | LONG RANGE PLANNING                            |
| 54 | Raisch and Birkinshaw (2008)       | Organizational Ambidexterity: Antecedents, Outcomes, and Moderators   | Journal of Management                          |
| 55 | O'Reilly and Tushman (2008)        | Ambidexterity as a Dynamic Capability: Resolving the Innovator's Dilemma  | Research in Organizational Behavior            |



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| 56 | Bessant (2008)                             | Dealing with discontinuous innovation: the European experience  | INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT   |
| 57 | Castiaux (2007)                            | Radical innovation in established organizations: Being a knowledge predator   | JOURNAL OF ENGINEERING AND TECHNOLOGY MANAGEMENT |
| 58 | O'Connor and DeMartino (2006)              | Organizing for radical innovation: An exploratory study of the structural aspects of RI management systems in large established firms | JOURNAL OF PRODUCT INNOVATION MANAGEMENT         |
| 59 | Lakemond and Berggren (2006)               | Co-locating NPD? The need for combining project focus and organizational integration  | TECHNOVATION                                     |
| 60 | Jansen, Van Den Bosch and Volberda (2006). | Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators  | MANAGEMENT SCIENCE                               |
| 61 | Westerman, McFarlan and Iansiti (2006)     | Organization Design and Effectiveness over the Innovation Life Cycle  | ORGANIZATION SCIENCE                             |
| 62 | Gupta, Smith and Shalley (2006)            | The Interplay between Exploration and Exploitation  | The Academy of Management Journal                |
| 63 | Siggelkow and Levinthal (2003)             | Temporarily Divide to Conquer: Centralized, Decentralized, and Reintegrated Organizational Approaches to Exploration and Adaptation   | ORGANIZATION SCIENCE                             |
| 64 | Leifer et al. (2001)                       | Implementing radical innovation in mature firms: the roles of Hubs  | Academy of Management Executive                  |
| 65 | Brown and Eisenhardt (1997)                | The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations               | Administrative Science Quarterly                 |
| 66 | Tushman and O'Reilly (1996)                | Ambidextrous organizations: Managing evolutionary and revolutionary change  | California Management Review                     |

Source: The Author

**Appendix 2 - Detailed list of interviewed**

| <i>#</i> | <i>Date</i> | <i>Firm</i>     | <i>Duration</i> | <i>Meeting</i>  | <i>Number of interviewed</i> | <i>Interviewed</i>   |
|----------|-------------|-----------------|-----------------|-----------------|------------------------------|--|
| 1        | 05/09/16    | Eletronics      | 50              | Presential      | 1                            | New Business Team Manager  |
| 2        | 05/18/16    | Generic Pharm   | 90              | Presential      | 1                            | Scientific Director  |
| 3        | 06/07/16    | Generic Pharm   | 60              | Presential      | 1                            | R&D Manager  |
| 4        | 06/14/16    | Generic Pharm   | 60              | Presential      | 1                            | R&D Manager  |
| 5        | 02/01/17    | CompAuto        | 60              | Conference Call | 1                            | Global New Product Portfolio   |
| 6        | 02/09/17    | Cosme           | 50              | Conference Call | 1                            | Innovation Process Manager   |
| 7        | 04/27/17    | Basic Chemistry | 90              | Presential      | 1                            | R&D Manager<br>R&D Manager Assistant   |
| 8        | 08/17/17    | Pharm           | 60              | Presential      | 4                            | Radical Innovation Nucleus Director<br>Radical Innovation Manager<br>(#2) Portfolio managers |
| 9        | 09/14/17    | Eletronics      | 50              | Conference Call | 1                            | New Business Team Manager  |
| 10       | 10/11/17    | Quim            | 105             | Presential      | 2                            | Innovation Coordinator<br>Innovation Analyst   |
| 11       | 11/07/17    | Quim            | 95              | Conference Call | 2                            | Innovation Coordinator<br>Innovation Analyst   |
| 12       | 11/22/17    | CompAuto        | 90              | Presential      | 1                            | Incubation Portfolio Coordinator   |
| 13       | 12/04/17    | Cosme           | 60              | Conference Call | 1                            | Portfolio Manager  |
| 14       | 12/13/17    | Quim            | 60              | Conference Call | 1                            | Innovation and knowledge manager   |
| 15       | 12/20/17    | Quim            | 60              | Conference Call | 2                            | Innovation Coordinator<br>Innovation Analyst   |

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|----|----------|----------|-----|-----------------|---|--|
| 16 | 12/20/17 | Quim     | 60  | Conference Call | 2 | Innovation Coordinator<br>Innovation Analyst   |
| 17 | 12/21/17 | CompAuto | 55  | Conference Call | 1 | Product Technology Manager   |
| 18 | 01/09/18 | CompAuto | 55  | Conference Call | 1 | Incubation Portfolio Coordinator   |
| 19 | 01/11/18 | CompAuto | 50  | Conference Call | 1 | Global New Product Portfolio   |
| 20 | 01/11/18 | Cosme    | 55  | Conference Call | 1 | Global Director of New Product Development   |
| 21 | 01/17/18 | CompAuto | 60  | Conference Call | 1 | Global New Product Portfolio   |
| 22 | 02/08/18 | CompAuto | 60  | Conference Call | 1 | Global New Product Portfolio   |
| 23 | 03/12/18 | Pharm    | 60  | Conference Call | 1 | Portfolio Manager  |
| 24 | 03/13/18 | Cosme    | 55  | Conference Call | 1 | Global Director of New Product Development   |
| 25 | 03/15/18 | Pharm    | 60  | Conference Call | 1 | Radical Innovation Manager   |
| 26 | 03/18/18 | Pharm    | 120 | Conference Call | 1 | Integrator Manager   |
| 27 | 03/20/18 | Quim     | 45  | Presential      | 1 | Innovation and knowledge manager   |
| 28 | 03/23/18 | Pharm    | 180 | Presential      | 4 | Radical Innovation Nucleus Director<br>Radical Innovation Manager<br>(#2) Portfolio managers |
| 29 | 03/26/18 | Pharm    | 60  | Conference Call | 1 | Portfolio Manager  |
| 30 | 04/04/18 | Pharm    | 50  | Conference Call | 1 | Researcher   |
| 31 | 04/05/18 | Cosme    | 30  | Conference Call | 1 | Global Director of New Product Development   |
| 32 | 06/21/18 | CompAuto | 45  | Conference Call | 1 | Global New Product Portfolio   |
| 33 | 07/12/18 | CompAuto | 90  | Presential      | 2 | (#2) Researchers   |
| 34 | 07/31/18 | CompAuto | 40  | Conference Call | 1 | Incubation Portfolio Coordinator   |

Source: The author