

## OPEN INNOVATION: A STUDY ABOUT THE 3M AND NATURA – BRAZIL COMPANIES

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### Abstract

**Objective:** The general aim of this study is to verify how Natura and 3M businesses included open innovation in their everyday practices.

**Methodology:** The chosen method is qualitative research of exploratory nature. The strategy adopted for the collection and analysis of data is based on the Grounded Theory approach guided by Charmaz's (2009) study in three distinct stages. At each stage of collection and analysis, the data was openly encoded (at first), followed by a more focused and theoretical coding to obtain the theoretical coding categories.

**Originality:** This study sought to enrich the knowledge on open innovation through research in 3M Brazil and Natura's companies, which allowed relating open innovation with organizational strategy and as a complement to the innovative process.

**Main results:** The results show that open innovation is understood by companies like a strategy that permeates the ecosystem to the complement of resources, skills, technology, and valuable knowledge in their relationships in the innovation process.

**Theoretical Contributions:** This research contributes empirically to broaden the understanding of open innovation as a company strategy. The results reveal open innovation as a strategy that permeates the ecosystem, in addition to complement resources, capacities, technologies, and knowledge that add value to the innovation process.

**Keywords:** Innovation. Open innovation. Grounded Theory.

### INOVAÇÃO ABERTA: UM ESTUDO SOBRE AS EMPRESAS 3M E NATURA - BRASIL

#### Resumo

**Objetivo do Trabalho:** O objetivo geral deste estudo consiste em verificar como as empresas 3M Brasil e Natura compreendem a inovação aberta em suas práticas cotidianas.

**Metodologia:** O método utilizado foi a pesquisa qualitativa de caráter exploratório. A estratégia adotada para coleta e análise dos dados baseou-se na abordagem da *Grounded Theory* orientados pelo trabalho de Charmaz (2009) em três etapas distintas. Em cada fase da coleta e análise, os dados foram codificados de forma aberta (inicial), seguida de codificação focalizada e codificação teórica.

**Originalidade:** Neste estudo buscou-se enriquecer o conhecimento sobre o tema inovação aberta, por meio de pesquisa nas empresas 3M Brasil e Natura, permitindo relacionar Inovação aberta com estratégia organizacional e como complemento para o processo inovativo.

**Principais Resultados:** Os resultados apontam que a inovação aberta é compreendida pelas empresas como a estratégia que

permeia o ecossistema para o complemento de recursos, capacidades, tecnologia e conhecimento valiosos em seus relacionamentos no processo de inovação.

**Contribuições Teóricas:** Esta pesquisa contribui empiricamente no sentido de ampliar o entendimento de inovação aberta como estratégia da empresa. Os resultados revelam a inovação aberta enquanto estratégia que permeia o ecossistema, no intuito de trazer como complemento, recursos, capacidades, tecnologias e conhecimentos que agreguem valor ao processo de inovação.

**Palavras-chave:** Inovação. Inovação aberta. Teoria fundamentada.

### INNOVACIÓN ABIERTA: UN ESTUDIO SOBRE 3M BUSINESS Y NATURA - BRASIL

#### Resumen

**Objetivo del trabajo:** El objetivo general de este estudio es constatar cómo las empresas 3M Brasil y Natura entienden la innovación abierta en sus prácticas diarias.

**Metodología:** El método utilizado fue la investigación exploratoria cualitativa. La estrategia adoptada para la recopilación y el análisis de datos se basó en el enfoque de la teoría fundamentada guiado por el trabajo de Charmaz (2009) en tres etapas distintas. En cada fase de recopilación y análisis, los datos se codificaron abiertamente (inicial), seguidos de codificación focalizada y codificación.

**Originalidad:** Este estudio buscó enriquecer el conocimiento sobre el tema innovación abierta, a través de la investigación en las empresas 3M Brasil y Natura, permitiendo relacionar la innovación abierta con la estrategia organizacional y como complemento del proceso innovador.

**Principales resultados:** Los resultados indican que las empresas entienden la innovación abierta como la estrategia que impregna el ecosistema para complementar recursos valiosos, capacidades, tecnología y conocimiento en sus relaciones en el proceso de innovación.

**Contribuciones teóricas:** Esta investigación contribuye empíricamente a ampliar la comprensión de la innovación abierta como estrategia de la empresa. Los resultados revelan la innovación abierta como una estrategia que impregna el ecosistema, a fin de aportar como complemento, recursos, capacidades, tecnologías y conocimientos que agregan valor al proceso de innovación.

**Palabras-claves:** Innovación. Innovación abierta. Teoría fundamentada.

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## Introduction

Companies have integrated firmly open innovation within their own growth and corporate renewal goals, which has led to a new application of open innovation (Vanhaverbeke, 2013; Chesbrough et al., 2017). Open innovation has emerged as an essential concept in both academic research and industrial practice (Bogers et al., 2018), and internal management challenges have been to align open innovation with the strategic objectives of the company (West et al., 2014; Bogers et al., 2018).

In this context, the search for strategic advantage has been focused in recent years, through the integration of activities and internal and external technologies through strategic alliances and partnerships, the virtual enterprise and the relationships with suppliers and buyers, networks and technology collaboration, which highlight the importance of open innovation to create business value (Chesbrough, 2017). Thus, open innovation has become an opportunity for companies in the search for innovation in a changing environment (Vanhaverbeke, 2013; Teece, 2014; Harel, Schwartz, & Kaufmann, 2019).

Open innovation has been presented as a strategic alternative for companies to gain competitive advantage through internal and external collaboration, identify opportunities, develop new markets and create value (Chesbrough, 2017; Chesbrough et al., 2017). However, the open innovation concept has performed broadly in literature and needs to be explored further, especially about its terminology, which has led to a growing critical perspective and a focus on development theories and implications management (Elmquist et al., 2009; Hossain, 2013).

Emerging market companies like Brazil have found open innovation as a way of accessing new ecosystems that allows them to improve the performance of the innovation process and expand new markets (Bogers, Burcharth, & Chesbrough, 2019). However, according to data from the survey on the state of innovation in Brazil - triennium 2015 - 2017 - it shows that of the 116,962 companies surveyed, only 1/3, that is, 39,329 of them were innovative in product or process, making up a general rate of innovation 33.6% in this period (Pintec, 2017).

A study with some of the largest Brazilian multinationals pointed to low use and limited understanding of open innovation assumptions, and highlights the importance of changing the mental model of research and development managers concerning the role of business models (Pitassi, 2014). Thus, in the practice of open innovation for the success of companies, it involves aligning their objectives and the ecosystem where they intend to operate while seeking to minimize their limitations (Almirall, Lee, & Majchrzak, 2014).

Thus, it is argued that for the company to leverage the use of open innovation for the benefit of the innovation process and exploitation of its ecosystem, it is necessary to understand how the company understands open innovation in its context and everyday practices.

Based on these considerations, the following research question surfaced: How open innovation is understood in 3M and Natura businesses? The main objective is to verify how 3M and Natura

included open innovation in their everyday practices of innovation. Thus, to achieve the proposed goal, we present the following objectives: a) identify the practice of open innovation in these companies and, b) check how open innovation is understood in both companies.

In seeking the meaning of open innovation from the understanding of these researched companies, we sought through Grounded Theory research methods using the criteria set by Charmaz (2009). Companies 3M and Natura were chosen because they develop open innovation practices in their innovation processes. This research contributes empirically to broaden the understanding of open innovation as a company strategy.

In addition to this introductory section, we discuss the literature on innovation and open innovation, methodological procedures, the search results, and finally, the conclusion and suggestions for future research.

## **Innovation**

Since Schumpeter (1934; 1943) and Penrose (1959), innovation has been identified as a relevant resource for profit and growth beyond the company's ability to manage it (Cantwell, 2001). Drucker (2002) argues that innovation is seen as a tool or instrument used by entrepreneurs to exploit change as an opportunity to be learned as well as practiced. According to this author, innovation is developed as a practice based on when, where and how to look so systematically for opportunities, as well as how to judge the chances of success or the risks associated with failure. Thus, innovation viewed in a systematic way is the intentional and organized search for changes and analysis of the opportunities that these changes can offer for both economic and social innovation (Drucker, 2002).

Tidd and Bessant (2015) highlight that innovation is more than just having good ideas: it is the process of making them evolve to the point of having a practical use (p. 18). The authors point out that the various definitions of innovation are differentiated in theory, but all refer to the need to complete the aspects of development and deepening of new knowledge, not only of his invention; that is, invention should not be confused with innovation, it is only part of a long process.

The path (process) of innovation, according to Van de Ven et al. (2008), is a nonlinear cycle of divergent and convergent activities that may repeat over time and at different organizational levels if resources are obtained to renew the cycle. However, the authors suggest that the core process of innovation is similar in organizational contexts structures. For the authors, this result brings significant benefits that can be achieved by integrating principles for the management of innovation and entrepreneurship in new startups, corporate venturing, and inter-organizational joint ventures that, in terms of the process of innovation, can be highly complementary.

Tidd and Bessant (2015) understand innovation as the process of turning ideas into reality and capture their associated values of survival and growth; it involves a level of abstraction, and therefore,

observe a common underlying process in all companies (search, selection, implementation, and capture value).

In the process of innovation, successful innovative companies realized the importance of links and connections outside and within organizations (Bessant & Philips, 2013). According to the authors, organizations have been close to customers to understand their needs, seek to work with suppliers to offer innovative solutions, associate with developers, research centers, and even competitors to build and operate innovation systems.

Studies developed by Tidd and Thuriaux-Aleman (2016) in 10 sectors with 292 companies identified that the leading significant innovation management practices associated with superior innovation performance were the use of external sources in a structured way; technology understood in terms of its quantified contribution to corporate objectives; frequent review of portfolios; and mobilizing the organization to develop new ideas.

Thus, several companies have sought new bases of knowledge building links and global external relations - GlaxoSmithKline, Procter & Gamble "connect and develop", GSK, 3M, Natura - taking the challenge to innovate openly not only on the side of R&D, but also on the market knowledge around customer needs and their desires (Bessant & Philips, 2013; Brunswicker & Chesbrough, 2018).

## **Open innovation**

Open innovation has been motivated by several reasons, by different actors, in the most distinct interactions of groups of partners in business - companies, suppliers, distributors, customers, competitors, universities involving risk sharing, pooling skills, developing markets, product creation, among others, to respond to environmental dynamics (Chesbrough, 2012; Vanhaverbeke, 2013; Gambardela & Panico, 2014). However, it presents the academic and industrial literature with a rather difficult and challenging management concept regarding its implementation, organizational structures, culture and knowledge seen as obstacles to change (Wikhamn & Styhre, 2017).

The challenge has also been to find new open innovation approaches involving various relationships that arise from co-development in the management of intellectual property, licensing, spin-offs, and other methods to absorb and create new opportunities of external ideas to the company to take to the market (Tidd & Bessant, 2015; Gambardela & Panico, 2014). The open innovation approach has been presented broadly in recent years innovation literature with different concepts and definitions (Elmquist et al., 2009; Hossain, 2013; Tidd & Bessant, 2018) as shown in Table 1.

**Table 1** - Open Innovation Approaches

Authors	Concepts and definitions
Chesbrough (2003)	Open innovation and is the value of ideas that can originate both inside and outside the company and can use internal and external paths to the market.
Gassmann and Enkel (2004)	Open innovation refers to how organizations use their internal and external sources and market paths to innovation or share innovation processes.
Chesbrough (2006)	The intentional use of inputs and outputs of knowledge to accelerate innovation in its own market and expand the use of internal expertise in foreign markets, respectively.
Vanhaverbeke (2013)	Open innovation has been presented as an important strategic alternative for companies to gain a competitive advantage through internal and external collaboration, to identify opportunities and develop new markets.
Tidd and Bessant (2015)	The open innovation model emphasizes the notion that companies must acquire third-party resources and share valuable internal resources for the development of new products and services.
Chesbrough and Bogers (2017)	An innovation process based on distributed management purposeful flow of knowledge across organizational boundaries.

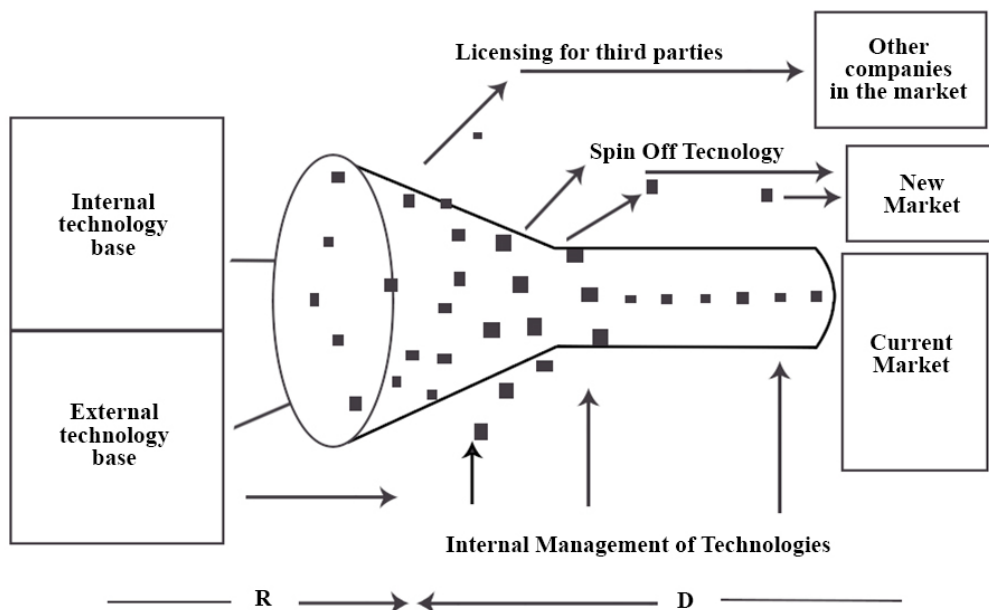
**Source:** Several authors.

The discussions on open innovation achieved greater emphasis from the study of Chesbrough (2003) on the grounds of an internal innovation change - closed - to a process of openness to external sources (cooperation in Research and Development - R&D). For this author, in the closed model the main argument to obtain a successful innovation process depends on the internal generation of ideas in developing, manufacturing, marketing, and distributing. In this closed design innovation model, the ideas that generate new products, processes, or services must be generated within the organization, which invests heavily in R&D.

In the closed innovation model, organizations believed in the philosophy that it should generate innovations on their own and thus guarantee a profit. In this way, the author highlights as consequences, the need for a greater inflow of investments in internal R&D to strengthen the facilities and resources to researchers. In addition, some problems are identified in the closed innovation process: a) rise and mobility of knowledge workers, b) difficulty for companies in control of proprietary ideas and knowledge, c) the increasing availability of venture capital, d) the complexity of the projects and, e) higher level of expertise in R&D (Chesbrough, 2003).

On the other hand in the open innovation model, as shown in Figure 1, it is often cheaper, and there are better results in buying R&D than developing your own. In this process, companies can sell external ideas to the market and sell their internal ideas throughout their current business channels, and value generation (Chesbrough, 2017).

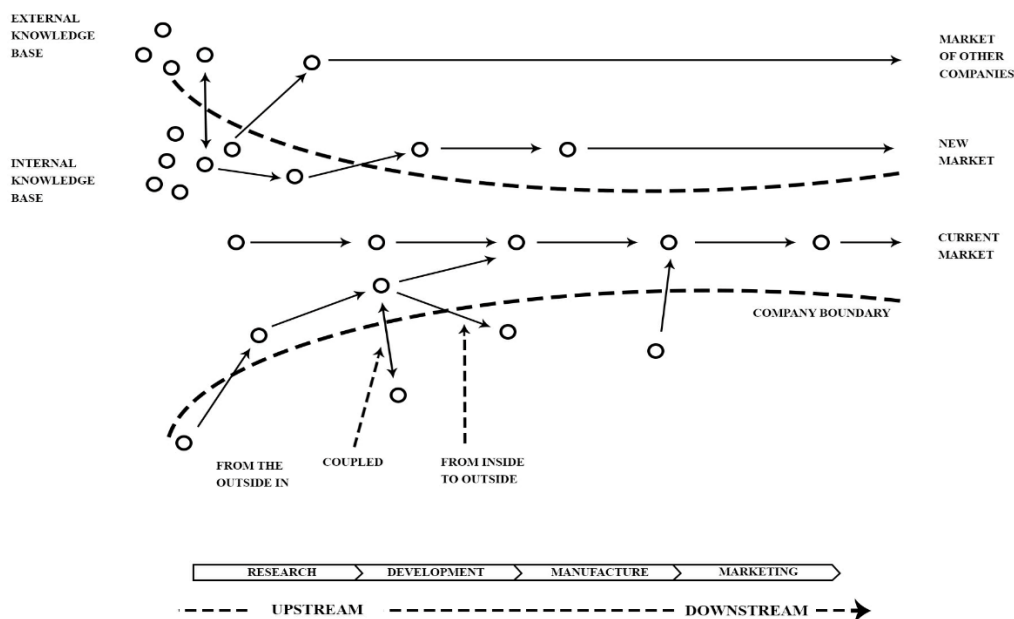
Figure 1 - Open Innovation Model



Source: Chesbrough (2003).

Chesbrough and Bogers (2017) developed an open innovation model that shows the different ways that knowledge or technology can follow, both inside and outside the company's boundaries, as shown in Figure 2.

Figure 2 - Open Innovation Model



Source: Chesbrough and Bogers (2017).

Figure 2 extends the amount of open innovation model upstream and downstream from R&D. At this time upstream, we begin the conception of the idea, invention or improvement of a new product, process or service, going further to the stage downstream of the innovation process, which is marketing and sales, which demonstrates the importance of reconciliation for all stages from the generation of the idea to the marketing of goods or services to aggregate and/or capture the value of ideas and technology (Chesbrough & Bogers, 2017). Pitassi (2014) points out that open innovation needs to be seen as an extension, adapting to the challenges of the techno-productive paradigm, the relevance of fertilizing R&D areas through the knowledge generated outside the company.

Tidd and Bessant (2015) point out that to understand open innovation it is necessary to explore the different types and degrees of openness and how much a company can benefit from internal and external resources and expertise to the process of innovation. The authors emphasize that it is necessary to identify opportunities to investigate the various collaboration strategies and the types and contexts of innovation sources and manage the different categories and degrees of relationships of a company with foreign partners involving varying degrees of openness to innovate in the value capture. The open innovation model emphasizes that companies must acquire third-party valuable resources and share internal resources to develop new products and services.

Bogers et al. (2016) argue that in open innovation we should identify elements at different levels of analysis. According to these authors, at higher levels, structures and processes, and lower levels, the individual capabilities to facilitate the implementation of open innovation or interdependencies between organizations and various stakeholders in an innovation ecosystem scenario. Companies must focus on open innovation in the search for new opportunities that an integrated ecosystem offers in terms of both capturing and creating value and connected with its collaborative and competitive strategies (Almirall, Lee, & Majchrzak, 2014).

Oberg and Alexander (2018) point out that the relationship between the undertakings could be developed, grouped and re-categorized in different dimensions of knowledge, like the levels of knowledge of the company or individuals, and knowledge as homogeneous or unique to the individual actors.

As pointed out by the European Union report in 2014 on boosting open innovation and knowledge sharing (Debackere et al., 2014), these are challenges for management and leadership skills in a more interactive environment, network, and collaborative to absorb internal and external ideas as the key to initiate growth. Bogers et al. (2018) discuss that the formulation of effective policies built around open innovation should take advantage of the added value of openness in science while promoting the investment needed to transform open initiatives in new technology and new models of business.

In small and medium enterprises using open innovation tools have been identified as effective (Harel et al., 2019), and the results have been useful for the managers of these companies to supply constraints and opportunities of open innovation practices (Hinteregger et al., 2019).

In the organizational environment, companies have sought to include open innovation within its growth and corporate renewal goals what has led to a new application of open innovation, that is, where collaboration with technology partners is mainly for building new internal technology skills (Vanhaverbeke, 2013; Chesbrough et al., 2017). Thus, the challenges of internal management have been to align open innovation with the strategic objectives of the organization (West et al., 2014; Bogers et al., 2018).

Bogers, Burcharth, and Chesbrough (2019) highlight the need to investigate companies from emerging economies such as Brazil, and question that they have limited open innovation strategies when they need in their innovation environment to attract external partners to overcome various restrictions, among them, institutional, resources and capacities that are necessary for its performance. The authors point out three relevant reasons: 1) the global R&D and innovation scenario has changed significantly with the expansion of technological talents and competencies worldwide; 2) the peculiarities of emerging economies make it a rich and prolific empirical context, and 3) collaborative strategies such as open innovation are especially necessary in periods marked by significant opportunities for innovation and great uncertainty in the economic environment.

Pitassi (2014) approaches that the application of the premises of open innovation in Brazilian multinationals can change the mechanisms of learning of their technological strategies to compete in a capitalist economy that has been marked by the globalization of knowledge. In this context of emerging economies, some themes have been relevant in the operationalization of open innovation practices, among which must be considered: Trust, corruption, and establishment of external relations; Hierarchical structures and implementation of open practices; Bureaucracy, lack of flexibility and exploitation of external knowledge; Culture and syndrome not invented here - (NIH); Comparative studies with other emerging economies (Bogers, Burcharth, & Chesbrough, 2019).

Pitassi (2014) in a theoretical and empirical study in Brazilian companies (Aché, Bematech, Braskem, Cemig, Chemtech, Cristália, Embraco, Embraer, Embrapa, EMS Fibria, Herbarium, Lupatech, Natura, Petrobras, Sabó, Tigre, Usiminas Vale and Weg) indicates that there is no strict and open innovation strategy that serves all competitive strategies and their consequent technological positions. In this study, the author evidenced that there is a low use, limited understanding of open innovation assumptions, and reveals the need for a change in the mental model of R&D managers regarding the role of business models. Thus, the success of companies in open innovation involves aligning their objectives with those of the ecosystem where they intend to prosper while minimizing their existing limitations (Almirall, Lee, & Majchrzak, 2014).

This study seeks to contribute to these previous discussions in two Brazilian multinational companies - 3M and Natura, verifying their understanding of the practice of open innovation in their daily lives.



## Methodological procedures

This research aims to verify how Natura and 3M Companies understand open innovation in their everyday practices. For the research design, it was necessary to develop a set of procedures and techniques guided by Charmaz (2009) through qualitative research of an exploratory approach using the Grounded Theory.

We used the Grounded Theory as it is a method of qualitative research that seeks to create conceptual schemes that lead to the development of theories that underlie the inductive data analysis. Thus, this method of research has contributed to emphasize the analysis and not the description of the data; it sought to develop new categories rather than have preconceived ideas of existing theories. Data collection was made sequentially and systematically (Charmaz, 2009).

The constant comparative method was used to analyze the collected data sets, which are encoded in an open theory based on (Charmaz, 2009). This choice was to establish analytical distinctions and make comparisons of data at each level of the systematic process, i.e., the comparison with data to identify the similarities and differences in interviews (Charmaz, 2009).

Multiple stages of data collection and refinement in the interrelation of categories have been developed for its operation. The unit of analysis in this study is configured as to how managers of these companies understand open innovation in the processes of innovation in 3M and Natura companies.

Therefore, coding practices were necessary as an analytical strategy that involved the word-by-word, line-by-line, and incident-by-incident coding and used the constant comparative method to establish analytical distinctions and thus be able to make comparisons at each level of the analytical process (Charmaz, 2009).

## Data collection instruments

For this study, we adopted the interview technique with semi-structured, open-ended questions with standardized and appropriate then every new step: initial coding, focused and theoretical, with their stages of collection and analysis of data.

To increase the credibility, validity, and quality of research, an interview script was initially used. The issues and topics were based on the preliminary review of the literature and developed from a validation matrix. The matrix linked specific objectives to the theoretical framework's main concepts that were initially identified in the initial coding and, subsequently, appropriate in the next phase, focused and theoretical coding.

The interviews were carried out with the companies 3M and Natura, as shown in Table 1 - Initial coding in Table 2 - Focused Coding and Table 3 - Theoretical Coding. In the initial coding phase, the manager of each company was interviewed. By applying a set of interviews covering eleven questions, an extract of this dynamic can be seen in Table 1.

**Table 1 - Interviewed in the initial coding and validation matrix**

Company	Interviewed	
3M	E13M	Ambassador of innovation and environment manager, health and product safety – EHS
Natura	E1Na	Manager – Management and innovation networks

**Research problem:**

How open innovation is understood in 3M and Natura businesses?

**Main goal:**

Verify how 3M and Natura included open innovation in their everyday practices of innovation.

Specific objectives	Theoretical reference	
<p>I). identify the practice of open innovation in these companies</p>	<p>Van de Ven et al. (2008): The path (process) of innovation.</p> <p>Tidd; Bessant (2015): It involves a level of abstraction, and therefore, observe a common underlying process in all companies (search, selection, implementation and capture value).</p> <p>Chesbrough (2003, 2012): Open innovation and is the value of ideas that can originate both inside and outside the company and can use internal and external paths to the market.</p> <p>Tidd; Bessant (2015): The open innovation model emphasizes the notion that companies must acquire third-party resources and share valuable internal resources for the development of new products and services.</p> <p>Chesbrough; Bogers (2017): idea generation to the marketing of goods or services in order to aggregate and/or capture the value of ideas and technology.</p>	<p>1 - Talk about the open innovation process of the company.</p> <p>2 - How are the open processes of innovation conducted?</p> <p>3 - Talk about what you consider open innovation.</p> <p>4 - Describe the open innovation trajectory in the company, when and how it was implemented.</p> <p>5 - How are the research and product innovation, processes, and service innovation in the transition from closed to open managed?</p>
<p>II). check how open innovation is understood in both companies</p>	<p>Chesbrough (2017); Chesbrough et al. (2017): Open innovation has been presented as a strategic alternative for companies to gain competitive advantage.</p> <p>Vanhaverbeke (2013); Chesbrough et al. (2017): Companies have integrated firmly open innovation within their own growth and corporate renewal goals, which has led to a new application of open innovation.</p> <p>Tidd; Bessant (2015): Company can benefit from internal and external resources and expertise to the process of innovation.</p> <p>Bogers et al. (2018): Open innovation has emerged as an important concept in both academic research and industrial practice.</p>	<p>6 - In which ways open innovation contributes to technological and market opportunities in the company?</p> <p>7 - Can open innovation practiced by the company create value for the customer? Talk about this process.</p> <p>8 - Could you tell me the lessons and benefits that open innovation provides?</p> <p>9 - Are there advantages identified in open innovation? What are they? Could you describe them?</p>

	<p>West et al. (2014); Bogers et al. (2018): internal management challenges have been to align open innovation with the strategic objectives of the company.</p> <p>Bogers et al. (2016): open innovation should identify elements at different levels of analysis.</p> <p>Hinteregger et al. (2019): opportunities of open innovation practices.</p> <p>Van de Ven et al. (2008): significant benefits can be achieved through integration and principles of innovation and entrepreneurship management in new startups, corporate ventures and interorganizational joint ventures, which, in terms of the innovation process, can be highly complementary.</p>	<p>10 - What about the challenges in the application of open innovation? Describe them.</p> <p>11 - What are the key factors in open innovation process?</p>
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**Source:** Prepared by the authors.

In preparing the questions for a semi-structured interview, in the encoding step, specific demands were structured like “talk about” “how,” “what,” “when,” “where,” and, more elaborately, “Could you describe, say, comment on “(Charmaz, 2009; Strauss & Corbin, 2008). Thus, the constructivist approach adopted in this study emphasized the attainment of participants' definitions as to the terms, situations, and events as an attempt to explore their assumptions, implicit meaning, and unspoken rules in the encoding phase (Charmaz, 2009) analyzed in section (4.1).

After analyzing the data of the companies surveyed in the initial coding phase, we returned to the field for a new data collection phase to investigate a bigger group of subjects, totalizing seven managers, three from Natura, and four from 3M. Thus, new questions were elaborated from the analysis of the data collected in the initial coding. In this new data collection phase, five interview script questions were applied, using the focus group as a strategy focused on the coding phase (see Table 2).

**Table 2** - Interview with Focus Group on Natura Company and 3M

Company	Interviewed	
Natura	E2Na	Manager – Management and innovation networks
Natura	E2Na	Manager – Pro-system innovation
Natura	E2Na	Partnerships manager, intellectual property and development for innovation
Natura	E2Na	Strategic Planning Manager
3M	E23M	Ambassador of innovation and environment manager, health and product safety – EHS
3M	E23M	Manager of technology platforms laboratories
3M	E23M	Senior Specialist Laboratory
<b>Questions applied in the interviews</b>		
1	What is the strategic approach of your company that opens the door to an open innovation opportunity?	
2	Talk about open innovation in the innovation process	
3	Comment on how open innovation relates to the innovation ecosystem	
4	Talk about forms of relationship in the ecosystem of innovation and the ones considered specifically linked to open innovation. (Collaboration, networks, partnerships, and licensing agreements, cooperation and knowledge generated).	
5	Comment on open innovation and complementarity in the innovation process	

**Source:** Prepared by the authors.

After analyzing the data collected from interviewees focused on coding as detailed in section (4.2), new inquiries were made via Skype interviews with the companies, shown in Table 3, in this phase of theoretical coding phase. Thus, new questions were elaborated from the understanding of the data collected in the focused coding.

In the Natura interview, four questions were made to one of the managers, all of them based on the first results of coding and focused on the search data saturation. Having a better understanding of the meaning of open innovation for the Natura company manager, we went on to the last data collection done between the two 3M company managers, on which four questions were applied, saturating the data in this final coding phase.

**Table 3** - Individual interviews at Natura and in pairs at 3M

Company	Interviewed	
Natura	E3Na	Networking manager
<b>Questions applied in interviews</b>		
1	Considering the previous data codification analysis, the data shows a convergence to the open innovation category in the company. What is your perception on this category?	
2	Considering the previous data codification analysis, the data shows a convergence to a category that suggests open innovation brings in the other half for the innovation process. What is your perception on this?	
3	Do you understand that open innovation is seen in the company's strategy and it brings the other half of the innovation process in the company? Comment on this.	
4	Do these two categories have any relationship? Comment on this.	
Company	Interviewed	
3M	E33M	Ambassador of innovation and environment manager, health and product safety – EHS
3M	E33M	Senior Specialist Laboratory
<b>Questions applied in interviews</b>		
1	Considering the previous data codification analysis, the data shows a convergence to the open innovation category in the company. What is your perception on this category?	
2	Considering the previous data codification analysis, the data shows a convergence to a category that suggests open innovation brings in the other half for the innovation process. What is your perception on this?	
3	Do you understand that open innovation is seen in the company's strategy and it brings the other half of the innovation process in the company? Comment on this.	
4	Do these two categories have any relationship? Comment on this.	

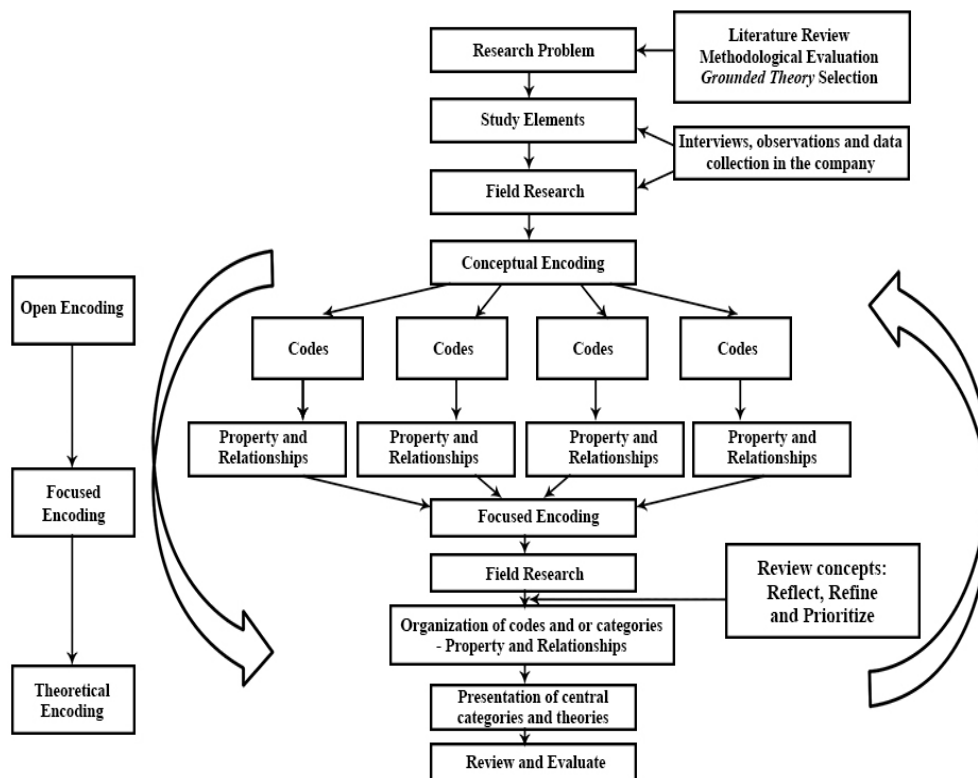
**Source:** Prepared by the authors.

Based on theoretical sampling of the interviews at all stages of encoding and data saturation there is a recursive process of return to the narrative found in the initial coding – E13M, E1Na, the targeted coding – E23M, E2Na, and the ones identified in the reports of respondents this coding theoretical – E33M and E3Na.

According to Charmaz (2009, p. 157), “the categories become saturated when the collection of new data no longer awakens new theoretical insights or reveal new properties of these central theoretical categories.” The theoretical saturation (Charmaz, 2009) and theoretical sufficiency (Dey, 1999) is achieved when the categories are suggested by the field of data in a recursive process, i.e., returning and recoding the above data to define new guidelines to enable one's clearer understanding of the categories. After collecting and analyzing data in the initial, focused, and theoretical phase of coding, we can identify that the main categories did not arouse new theoretical insights and new properties.

As indicated in Figure 3, one can obtain a systematic way to understand the not so linear process of the Grounded Theory research, which starts from the a priori identification of a substantive area of study and research problem.

Figure 3 - Linear Search Process for Construction of a Grounded Data Theory



Source: Adapted from Charmaz (2009).

Throughout the process of collection and data analysis, at the encoding stage (initial, focused, and theoretical) through interviews at Natura and 3M Companies, we used the NVIVO® V11 program to identify the codes that would be used in the analysis of the results.

**Data analysis and results**

In the following sections, we present the results of the analysis of each coding phase - initial, focused, and theoretical - and excerpts from some narratives that corroborate the understanding of innovation practices opened by companies.

**The initial coding**

The results found in the analysis of the interviews with E13M and E1Na (Table 1), as seen in the initial coding narratives, preliminarily indicated that the practice of open innovation within the company must be related to strategic planning. This way they seek to establish the open innovation strategies, the process of participation in their projects, processes, and their role in deciding which gateways will be open to bring the other half through the innovation process. According to Tidd and Bessant (2015), innovation, as the process of turning ideas into reality and capture their associated values

of survival and growth, involves a level of abstraction, and therefore, observe a common underlying process in all companies (search, selection, implementation and capture value).

For the interviewees E13M and E1Na, the management of open innovation regarding their business flows and processes occur in the innovation process in each ‘Stage Gate’ in the innovation funnel, i.e., it is not the perception of separated management, but in the very regular process innovation. This note corroborates with Bessant and Philips (2013), who say that in the innovation process, successful innovative companies realized the importance of links and connections outside and within organizations.

In the initial coding the narratives of E13M and E1Na identified, preliminarily, some codifications that contributed to the understanding of open innovation practices and their relationships regarding the subsequent construction of categories. Table 4 shows the initial codes and some narratives that initially supported the understanding of the data from interviews with E13M and E1Na.

**Table 4 - Codes of identification and Narratives in the Initial Coding**

<b>COD1: Construction Analysis of Trends and Strategies</b>	E13M - "it is required that the company has the ability to translate the megatrends and see the impacts on business. The company should have the ability to identify, organize and make investments to obtain returns from the megatrends and have the ability to identify the problem and deliver the solution. "
	E13M - "The company must be oriented to the business opportunity that generates a probability of success. This value creation opportunity in business is to improve the identification of insight innovation opportunities. "
	E1Na - "From the business that is identified in business opportunities strategies, establishes the need for innovation as far as the rhythm, differentiation and guidelines. Thus, the main driver of the company's growth is the one coming from innovation. "
	E1Na - "The sources of the process of innovation and open innovation include programs, universities, companies, suppliers, consultants, consumers, sales channels, open innovation events, business model startups, providing services through knowledge management tools, companies seek innovation from any source through interaction and relationship."
<b>Cod2: Innovation Ecosystem</b>	E1Na - "The connection to the innovation ecosystem depends on the ability to interact with actors via projects, platforms, workshops, Facebook, networks with consumers, researchers, universities, Startups".
	E1Na - "The company needs to understand what is the effect, which is the value of innovation for the whole marketing channel; before reaching the target customer, as well as it needs to understand which is the value for the actors of these channels, as the company does not innovate alone. Furthermore, there should be a connection to the supply chain, not to be limited to its internal capacity."
	E13M - "In the innovation ecosystem one can identify cross agents that are external agents such as academia, government, advertising agencies, market research among others."
	E13M - "The Open Innovation concept is the whole ecosystem with all ports, connections and interactions and thus has as its central purpose turn the company more competitive, to bring a return, gain value. In addition, it seeks to improve the monetary return on investments guided by open innovation opportunities of value creation. "
<b>COD 3: Investment and</b>	E1Na - Through the articulated investments map in strategic planning, it is pointed out the necessary investments to be made in technologies and human capital, which can translate into products for commercialization.
	E13M - "In strategic planning we should identify the investment capacity on portfolio renewal, investment in CAPEX (plan, machinery, equipment, and laboratory),

<b>Technological Competence</b>	<p>investments in functional skills via in-person and virtual training, and vascular network to have technological competence."</p> <p>E13M - "Culture is the vitamin that accelerates technological competence."</p>
<b>Cod4: Culture, Behavior and Communication</b>	<p>E1Na - "The company requires significant behavior in the culture of innovation, as the company's ability to talk to everyone, be enterprising, interested, collaborator with everyone. Communication is a behavior that should be encouraged by the company".</p> <p>E1Na - "In the innovation ecosystem, mechanisms of communication and collaboration related to the cultivation practices and environmental culture that reinforces the desired behavior must flow."</p> <p>E13M - "Recognition of innovations by employees are seen as a practice that strengthens the process. The expected behavior between commercial and technical parties points to a culture of innovation and freedom of creativity without borders, without limits, but with ethical inflexibility".</p>
<b>Cod5: Competence Combination</b>	<p>E1Na - "The company should work to identify the knowledge level of their competences, thinking about their future and their innovation opportunities to find new skills that need to be worked on or developed."</p> <p>E13M - "The company seek,s in its diversity of product platforms and projects and its core competence, to combine technologies to form products in new demands in the market."</p> <p>E1Na - "The combination of competence within the process in developing a project evolves management and how it is made, enabling emerging new knowledge in convergence to combine, integrate materials, products, technologies, projects and skills."</p>
<b>Cod6: Open Innovation as a complement to the process of innovation</b>	<p>E1Na - "In companies we identify two complementary paths towards open innovation as: 1) find the complementary skills and learn to internalize them, and 2) find the complementary expertise and continued collaboration."</p> <p>E13M - "The company sought complementary skills to measure its shortcomings in the innovation process, its projects, from there, there is the connection with the open innovation opportunities."</p> <p>E13M - "The company must pay attention to the contours to open the doors of innovation, must have controls, mainly related to intellectual property."</p> <p>E1Na - "The engagement happens and works only in strategic and complementary manner with culture of collaboration, openness of flexibility and fault tolerance to flow. The focus is in complementary expertise, so the company gains a competitive advantage."</p> <p>E13M - "Companies look into complementary competencies in search of solutions with docking, coupling and connections that come from startups and other business relationships."</p> <p>E13M - "Open innovation opportunities are also in the integration of materials, complement and combination of materials, or technology platforms."</p> <p>E13M - "Complementarity is a benefit in open innovation that is good for both parties, bringing solutions to the market situation."</p> <p>E1Na - "Complementarity is a benefit in open innovation because it brings technology expertise to the company and creates the potential to leverage return on this knowledge, this connection with the other parties, the external that generates the benefit of speedy delivery of products to the market."</p>
<b>Cod7: Possible Ways Relationships</b>	<p>E1Na - "The possible forms of relationships are collaborative, establishment and building of partnership, cooperation, networking, making supplier, licensing and contracts."</p> <p>E1Na - "In the whole ecosystem has to be very smooth and a lot of collaboration for innovation of a product / project, the exchange of information has to circulate throughout the ecosystem, the more happens, the greater the likelihood of finding a solution, and it just happens with the collaboration. "</p> <p>E13M - "The company should value the expertise but should value which contributes to the environment in the innovation ecosystem, as well, this is a vitamin that occurs in open innovation."</p> <p>E13M - "The company has a team overlooking everything and guiding researchers, employees and it seeks to structure the team basis and let everything in the innovation</p>



	process follow its own course, involving itself on complex matters, that is the source of all learning.”
<b>COD8: Open Innovation as Strategic Alternative</b>	E1Na - "The way the company offers a solution is what makes or breaks an open innovation opportunity."
	E1Na - "If the company wants to innovate, the best path to take is through open innovation, so it shall be the path taken."
	E1Na - "The company needs to know about open innovation to analyze their strategy."
	E13M - "Open innovation is a strategic choice of the company, i.e. it is a strategy on how to innovate."
	E1Na - "The process of innovation is the opportunity to pursue open innovation."
	E1Na - "The company establishes innovation strategies from the priorities of the operating mode how it will be done by aligning the expectations clearly to establish the structure so that the business process should flow."
	E13M - "The advantage of open innovation is to have a more relevant innovation, in addition to the advantage of speed to integrate something complementary to the innovation process."
	E1Na - "The challenge is to have an innovation strategy that points the way to opening doors to open innovation that matters to business."

**Source:** Prepared by the authors.

From the theoretical sampling and using the comparative method in the analysis of interviews with the accounts and E1Na E13M, we developed the preliminary coding of the data for subsequent data categorization.

### Focused coding

At this stage of focused coding, we began to outline the content and form of the analysis in development; that is, we tried to treat focal codes and experimental categories to decide whether they are categories (Charmaz, 2009).

As data collection in the coding phase focused on E23M and E2Na respondents as (Table 4), we defined two main categories - Category 1 - open innovation in the company's strategy and Category 2 - open innovation brings the complement in the innovation process to focus the discussions. The other codes indicated in the initial coding were incorporated in the discussions of the two categories.

These two categories were developed from the understanding of the data in the initial coding and were reworked in focused coding with the use of NVIVO® V11 program. They were elevated to this condition to explain the ideas that were built in the process of analyzing the data from the narrative of the interviewed companies 3M and Natura, as shown in Table 5.

**Table 5** - Categories and Narratives in Focused Coding

<b>Category 1: Open Innovation in Company Strategy</b>	E2Na - "Open innovation is within the innovation process, only reinforcing what we already have as capacity in the process because you are not doing it alone."
	E2Na - "Think of a model we capture nowadays in strategic planning."
	E2Na - "How much do I already have of it internally that I want to strengthen, indoors or outdoors; then I'll have the vision of who's doing it, who is working on these issues on the market that can be a potential partner that could help me choose something for my open innovation strategy."
	E2Na - "An intrinsic exercise of who is developing an open innovation strategy, where we'll actually invest efforts from what actually I have to map internal competencies."
	E2Na - "We have in our strategy the principle we should act openly."
	E2Na - "Understanding the risks of sharing, the difficulties in the partnership and the skills needed in open innovation and the innovation process all need to be considered in strategic decisions."
	E23M - "Open innovation is the company's thought of planning from the establishment of strategies to how to act on topics that arise from the analysis of trends or megatrends to capture business opportunities."
	E23M - "The analysis of the trend and the strategy that was set up for the business opportunity, oriented to these trends, will signal that we have the need for complementary actions."
	E2Na - "Open innovation comes to leverage the strategic priorities that have been established."
	E2Na - "I think starting with establishing the strategy of which are your priorities, you got open innovation as a leverage tool of the company's investment potential and acceleration of the acquisition of knowledge or the implementation of a project that has complementary knowledge."
<b>Category 2: Open Innovation complements the Innovation Process</b>	E23M - "This is what it is. Open innovation is a supplement. So it is the very definition of open innovation, if I do not have internal resources, I will seek somebody else who does."
	E23M - "It is extremely complementary when we are working on an innovation project and we do not have a certain competence resource."
	E23M - "We then get into this complementary extra."
	E2Na - "What adds to the project is not open innovation itself but the knowledge and resources you bring from outside the company."
	E2Na - "It's not open innovation itself as complementary; it's the possibilities of having external resources that it brings."
	E2Na - "It brings the complement; it is not the competence itself."
	E2Na - "It can be seen as a complement, but then I think, it is a way of looking at that dynamic capacity for innovation, and open innovation is one of the ways you can recombine resources. Nevertheless, in itself it brings resources to complement what you already have at home. "
	E23M - "Possibly it will open a door to some important addition that will help in delivering the project."
	E23M - "It complements day by day activities."

**Source:** Prepared by the authors.

The interviewees' answers presented in Table 6 reinforce the understanding that open innovation has been understood in the strategy and business innovation process. This seems to involve the decision and strategic action at any stage of the innovation process for defining issues, the projects that guide the way we operate in the innovation process and how they relate to the innovation ecosystem with its partners. This understanding corroborates with West et al. (2014) and Bogers et al. (2018) that the challenges of internal management have been open innovation aligned with the organization's strategic objectives.

Open innovation, according to E23M and E2Na, allowed the addition of complementary resources, skills and knowledge needed to make the projects in the innovation process from the

relationship and interaction with the ecosystem of innovation. This result reinforces the understanding of Van de Ven et al. (2008) on integration benefits, principles of innovation management, entrepreneurship with startups, corporate ventures, and inter-organizational joint ventures in the innovation process as complementary.

This understanding comes from E33M and E3Na accounts focused on the coding phase in the process of saturation of data.

### **Theoretical coding**

The constructivist grounded theory "establishes the priority in the study of phenomena and sees both the data and the analysis to have been generated from shared experiences and relationships with participants" (Charmaz, 2009, p. 178). Thus, from the data collected in this theoretical coding phase with E33M and E3Na, assumptions were made that allowed us to understand how open innovation is developed, operationalized, how it influences the process of innovation and its relation to the innovation ecosystem to bring resources to the company.

### **CAT1 - Open innovation is the strategy**

This open innovation category is the strategy identified in the interview with E33M. As they reported, "the open innovation concept encompasses all the company's connections and happens throughout the chain, supplier, academia, target customer and our customer's customer." So E33M understands that the concept of open innovation considers connections throughout the supply chain, it would not be exactly a strategic alternative, and it is the way that the company innovates. According to E33M:

"Open innovation is the strategy itself. Innovation is the company's vision, as we innovate; we have connections with the open innovation ecosystem in the whole supply chain. It is not whether we are connected or not. We are always connected with the ecosystem. Therefore, it is not an alternative. It is part of the core strategy of the company to open innovation across the ecosystem, with connections across the innovation ecosystem. Open innovation at 3M is organic "(E33M).

- In this sense, based on those interviews, "the company's strategy is always to do it, and in an open way on all points of the chain, and thus open innovation brings the complement whenever there are established foreign connection." The meaning of open innovation for E33M "is to be out there and understand what the difficulties are, what are the needs, what is the demand to which the product needs to be adapted."

## CAT2 - Open innovation brings resources to the innovation process

This category is identified as the narratives of E3Na and E33M subjects. For E3Na, "We define it as something that completes skills we already have, it fulfills its purpose that way." These add-ons, according to the interviewees, brought by open innovation, include several features that can be financial, human, organizational, and bring additional skills.

According to E33M, "open innovation certainly brings resources, we do not work alone; it is even much more than an extra." As told by the E33M during the interview:

"It brings the extra, the resource as we said throughout the supply chain, so we need to understand the contributions our supplier can bring in. We need to have a very good view of the market, so we need channels of communication and openness with our target customers to understand what the customer demands are." (E33M).

The results of Cat. 1 and Cat. 2 corroborate Bogers et al. (2016) that argue that in the innovation ecosystem scenario, elements at higher and lower levels, structures and processes and individual resources that facilitate the implementation of open innovation or interdependencies between organizations and various stakeholders should be identified.

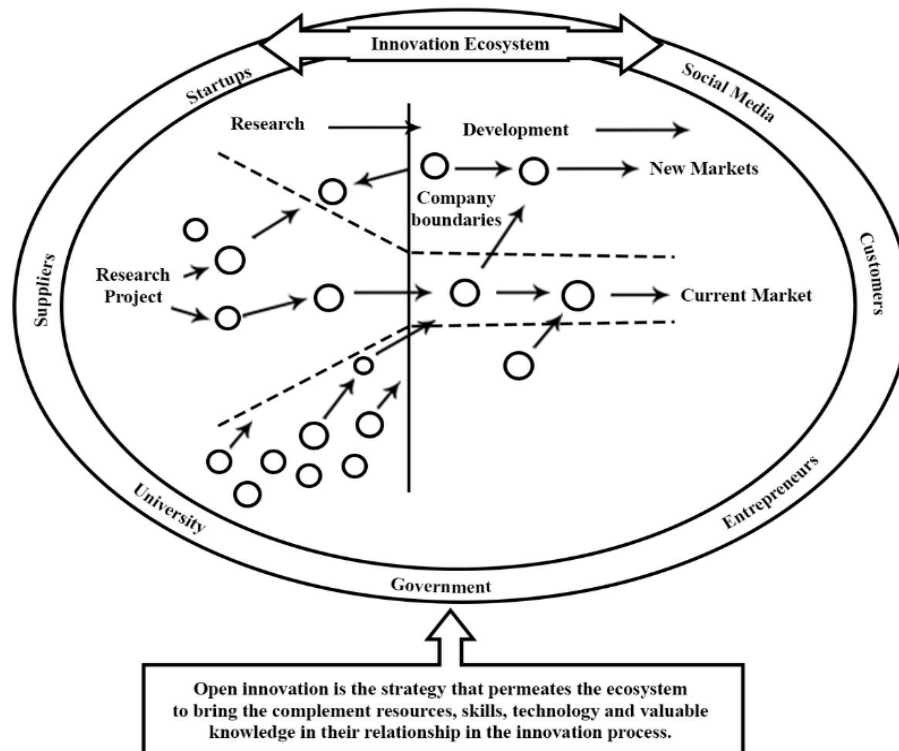
The following section provides the consolidation of Cat1 and Cat2 categories for the formation of a central category.

### Central category

The Cat1 Category - Open Innovation is the Strategy and Cat2 Category - Open innovation brings resources to the innovation process that were consolidated to form the central category. This consolidation created the central category - grounded theory - Open innovation is the strategy that permeates the ecosystem to bring the complement resources, skill, technology, and valuable knowledge in their relationship in the innovation process as represented in the diagram of Figure 4.

Charmaz (2009) points out that the use of diagrams allows you to show concrete images of ideas in research and enables the perception of relative power, scope, and direction of the codes or categories under review, in addition to the connections that exist between them.

Figure 4 - Diagram of Open Innovation



Source: Authors.

This understanding is seen in E3Na and E33M interviews and several lines of those interviews present in the phases of initial and focused coding. E33M exemplified in their reports that they corroborated with the formation of the central category:

"We might have a project where we need adhesive distribution in the market, and we identify that we do not have a good partner to perform that job in national scale. In that case we shall look around for a better-suited partner for that job, look out for someone who has the skills. In another project, we might have a competence deficiency; we will need a software to finish the project. So, I must stay on the lookout for partnerships, be it a startup or another company who developed software for that purpose."(E33M).

In another example that helps to strengthen the argument of this study, E33M says:

"It could be a technology-based situation if, I needed a new temperature resistant resin. If I can't identify it with any of our suppliers I could even try and find it in a university project, maybe try and produce it working with a research team, to understand how to produce a more resistant resin. We do this all the time, it's not exactly a strategic alternative, we do it in all projects and eventually, in a certain one, we might not look for it outside the company because we won't waste time if we judge something we already got as good."(E33M).

E33M reinforces in another interview the understanding that generated the formation of the central category in another bit that says:

"We do it all the time because it is our strategy to do it always, and in an open way throughout the chain and it brings resources, obviously, it always does. Whenever we establish this external connection, it is in search of resources, for sure. The purpose of open innovation is to be out there and understand what are the difficulties, what are the needs, what is the demand to which the product needs to be adapted."(E33M).

Based on the E33M interview, the client brings more assertiveness than the technical, runs through the product, the strategy itself. If we are not looking at the customer, if we are looking for the product there at the end of the chain, the chance of committing a mistake is very high. Therefore, there should be a connection all the time with the market, with customers, with partners to work again on every model and see what's going on. Open innovation at 3M is organic (E33M).

As we saw in the E33M interview, in the ecosystem, the definition of how the interaction with the external partner should be is a relevant questioning that affects open innovation strategies, as E33M observed:

"These inputs, i.e., open innovation is happening at all times. If I do not have that internal competence, I have the opportunity to identify it externally, that is, I am open to see which are the partners that can bring that skill. We have full autonomy and opening to define a model of interaction with this external partner. It can be via a purely service partnership, it can be an acquisition of services like so many that occur. We are open throughout the chain for different forms of trading interaction with these external partners "(E33M).

Therefore, based on the narratives and meanings of respondents in all stages of codification and categorization, it was found that **open innovation is the strategy that permeates the ecosystem to bring the complement resources, skills, technology, and valuable knowledge in their relationships in the innovation process.** This result complements what Almirall, Lee, and Majchrzak (2014) claim: the success of companies in open innovation depends on aligning their objectives with those of the ecosystem where they intend to prosper, minimizing their existing limitations.

This result corroborates Vanhaverbeke (2013) who points out that some companies use open innovation in a completely different way from standard case studies have presented in the literature. The author argues that open innovation potential cannot be performed since it is not connected to the corporate strategy. In this way, the result indicates that the surveyed companies understand the importance of open innovation as an innovation strategy that permeates the ecosystem bringing the complement of resources, skills, technology, and valuable knowledge in the innovation process. Moreover, it corroborates with West *et al.* (2014) who point out that the challenges of managers in companies have been aligning open innovation with strategic goals.

## Concluding remarks

This paper aims to check how Natura and 3M understand open innovation in their everyday practices. To meet the objectives and answer the research problem that questioned "How open innovation is understood by 3M and Natura companies," the methodological procedures used Grounded Theory guided by the work of Charmaz (2009), with support of NVIVO ® V11 software during the process of data collection and analysis. The constant comparative method was used to analyze the sets of collected data that were initially encoded openly, followed by focused coding and finally, by theory-based.

In response to the research question, it was found in the practices of 3M and Natura companies that **Open innovation is the strategy that permeates the ecosystem to bring the complement of resources, skills, technology, and valuable knowledge in their relationships in the innovation process**. The reasoning that supported this argument revolves from the interpretation of the data from the interviews in this study, which contributed to this understanding.

As an academic contribution, this research contributes to understand open innovation as a business strategy systemically. As a managerial contribution, this research provides to all managers who work with open innovation practices in their companies to explore the external and internal environment in the search for resources, skills, valuable knowledge, and technologies to the innovation process.

Thus, corporate contributions are seen in examples, and ways of implementation in practice of the respondents in various actions and strategic decisions in their daily lives might have reported. These actions and strategic decisions are related to the exploration of the ecosystem (suppliers, customers, government agencies, government, education and development institutions, enterprises, startups, and others) to bring complementary resources to the innovation process.

The results are based on the experience and vision of innovation managers from 3M and Natura companies practicing open innovation. These results provide elements to reflect on these practices and contribute in the actions and management decisions of managers. The results identified both in the literature review and in the field, support the assumption made in this study that for the company to enhance the use of open innovation for the benefit of the innovation and exploration process of its ecosystem, it is necessary to understand how the company understands open innovation in its context and everyday practices.

Given the results, some limitations of the research need to be highlighted. The number of companies surveyed in the sample prevents a generalization of the results obtained; the analysis and interpretation of the data is subject to subjective understanding by both the interviewee and the researcher. However, it is understood that the two companies studied are recognized worldwide for their innovation capacity. Despite different branches, it was possible to interview managers directly involved in open innovation, which brings quality to the results obtained. This limitation can be minimized by

developing triangulation by different forms of data collection and analysis using the method of Grounded Theory.

Future research can explore some opportunities for new studies related to open innovation. We suggest issues dealing with capabilities that are required for the growth of the company, to explore the behavior and power of actors in open innovation that influence the innovation ecosystem, and that seek to explore open innovation in the forms of relationships as they can be combined to bring the complement to the innovation process. With these subjects of study, we can project up the opportunity to explore them in greater depth, their impact and influence on open innovation.

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