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Open Innovation: Implementation Process in
Portuguese Enterprises

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Biographical Note

Ana Sofia Faria de Sousa was born in Johannesburg, in South Africa, on 1987. She graduated in Economics in 2010, from the University of Economics in Oporto. In the same year, she decided to complete her study, joining in the master's degree in Economics and Management of Innovation, having completed the curriculum component in 2010. She started the project of thesis, in 2011, under the orientation towards teacher Raquel Filipa do Amaral Chambre de Meneses Soares Bastos Moutinho, from which resulted the present research project.

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Abstract

The concept of Innovation as a trigger factor to development is completely accepted. Many authors (Schumpeter, 1934; Hall, 1987; Dosi, 1990; Chaney *et al.*, 1991; Freeman, 1994; Carlsson, 1994; Rothwell, 1994; Motohashi, 1998; Besanko *et al.*, 2000; Klomp and Van Leeuwen, 2001; Tidd, 2001) have demonstrated the impact of innovation on economic development and, in particular, on all the companies performance. Traditionally, firms had R&D departments with internal researchers and resources: it was the time of Closed Innovation. Nowadays, another paradigm emerges - firms are linked to innovation networks and knowledge flows: it's the era of Open Innovation (Chesbrough, 2003).

In this project we intend to investigate how the transition process has evolved from the traditional model of closed innovation into an open model of innovation in Portuguese enterprises, highlighting its impact and changes during the process.

According to the proposition under investigation, the qualitative research were developed through an analysis of the semi structured interviews conducted to each representative of these companies, in order to understand the introduction process of the OI concept within Portuguese companies. Following a "Systematic Combining" approach (Dubois and Gadde, 2002), at the end of the analysis, it was performed a reassessment of the theoretical model, adjusting it whenever it was necessary.

In short, what we wanted to understand was the changes that such strategic restructuring required in the Portuguese companies structure: number of phases, facilities/difficulties and goals. The results obtained from the comparison of the interviews showed that there are five stages in the implementation process of the OI model, each one with different features and goals.

Keywords: *Open Innovation; Organizational Change; Emergency; Inbound*

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1. Introduction

In recent years it is increasingly noticeable the constant rethinking of national business models and the increasing business competitiveness driven by globalization. Thus, it is even more important which strategic choice should be adopted by a company and how that new concept is introduced within it. The question becomes innovate inside or outside the own enterprise?

In the traditional model, defined by Chesbrough (2003a) as Closed Innovation approach (CI), each company creates its own ideas, develops and supports itself. However, the perception within companies that innovating internally is not enough, led to the need for an opening of their processes to incorporate ideas from abroad, new research projects and new concepts, being these actions considered part of Open Innovation concept (OI) (Haour, 2004; Kirschbaum, 2005; Vanhaverbeke, 2006; Huston e Sakkab, 2006; van de Meer, 2007).

Chesbrough defined OI, for the first time, in 2003, in his book "Open Innovation: The New Imperative for Creating and Profiting from Technology" as an "intentional use of inputs and outputs knowledge to accelerate internal innovation and expand the markets for the external use of innovation, respectively" (Chesbrough et al., 2008, p. 1). So, in this paradigm the barrier between the "company and the surrounding environment is porous, enabling to move more easily between the two" (Chesbrough, 2003b), at anytime and anywhere. But how can a firm change the paradigm? Which steps should a firm, working in the CI, must take to become an OI? This research project tries to answer these two questions, designing a paradigm change framework.

This new paradigm placed the concept of innovation as a key competitive strategy, which can increase the efficiency of companies' investments in R&D and enlarge the exchanges and cooperation between them (Dahlander and Gann, 2010), creating innovation networks.

It is noteworthy to emphasize that although it is a relatively recent concept, its applicability is possible to observe in the past, as there is already evidence of its existence in the late 19th century and early 20th century (Mowery, 2009), describing it as *old wine in a new bottle* (Trott & Hartmann, 2009). Mowery (2009) went further and suggested that history shows a constant presence of OI practices, being CI the exception to the rule.

There are many academic works related to this topic that demonstrate an increasing interest on this theme, for example, Christensen et al. (2005), Fleming and Waguespack (2007), Gassmann and Keupp (2009), Almirall and Casadesus-Masanell (2010), Dahlander and Gann (2010), Saur-Amaral e Amaral (2010), Lichtenthaler (2011), among many others. Cohen and Levinthal (1990) pointed out studies prepared in this context but without the specific use of the word OI. In this project, it will be only consider the recent emergence of this concept and its subsequent use in the Portuguese business structure.

Opening the company barriers represents a challenge as complex as innovating within the company itself and so, there is still much to explain and understand. Through a review of literature, as shown by Lopes and Teixeira (2009), there seems to be a focus on two distinct elements but correlated: the absorption and the transference of knowledge or technology to other entities (Enkel et al., 2005; Chesbrough and Crowther, 2005; Lichtenthaler, 2008). This can be explained, according to: the licensing of intellectual property (Sheehan et al., 2004), the development of partnerships (Piller and Walcher, 2006; Van der Meer, 2007; Chiaroni et al., 2009; Belussi et al., 2008), the creation of relationships between companies and the scientific and technological system (Harwing, 2004; Blau, 2007; Perkmann and Walsh, 2007; Link et al., 2008), the launch of new spin offs companies and the existence of mergers and acquisitions (Parhankangas et al., 2003). This new approach allows the existence of multiple marketing standards for innovative ideas which ensures a more appropriate and complete business model (Hoffman and Schlosser, 2001), associated to an aggressiveness of the intervenient (Goffin and Mitchell, 2005) or through a significant reduction of costs and risks of the innovation process (Gassmann, 2006; Collins, 2006;

Chesbrough and Schwartz, 2007), but still maintaining economic growth and revenues (Chesbrough and Crowther, 2006).

The choice of this theme is selected because it is a recent concept and little explored in Portugal, but already shows an importance in structural processes for Portuguese companies. In this sense, the study that serves as a starting point for this theoretical analysis belongs to Chiaroni et al. (2009) and it is related with the idea of several others authors in the creation of multistep models (Pettigrew and Whipp (1991), Kotter (2007), Hussey (1996), Galpin (1996), Korowasjczuk et al. (2000), Vanhaverbeke et al. (2008), among others).

Based in a Systematic Combining Methodology (Dubois and Gadde, 2002), what we propose is to confront all data and resetting the theoretical model, whenever necessary. All information collected will be based essentially on direct semi-structured interviews and complemented with some documentation (Chiaroni et al., 2009).

This project is structured in four chapters, including this introduction. In Chapter 2, we will analyze and draw together the existing literature considered important, in order to define the theoretical framework. Thus, the intention in chapter 2 is to define this study's limits and key concepts in order to understand the differences between the Open versus the Closed approach. It is also made clear the basic theoretical model considered in the implementation of the study of Open Innovation in some Portuguese companies.

In Chapter 3, the practical application of the research question is shown with the presentation of the research methodology used in this work, as well as the criterion used in the choice of target companies for this study. During this chapter we will include the description of the individual companies selected for the study and, subsequently used to make a comparative analysis in relation to the chosen base theoretical model. In this way, it will be reviewed and analyzed the differences reported, so that there will be a constant rethinking of the basic theoretical model, in order to obtain the necessary empirical evidence to clarify the research question.

Finally, in Chapter 4 all the differences will be consolidated and new aspects appointed in the analyses of the Portuguese enterprises. Therefore, the analyses it will be combined with literature mentioned to highlight the principals' contributions of this concept. The conclusion reached in this project with its associated discussion (benefits and limitations) will enable the emergence of new issues, something more than providing answers.

2. *Open Innovation: a literature review*

2.1. Initial Considerations

The concept of OI demonstrates a long and arduous process of studies and analysis that have been undertaken in the field of innovation. According to Chesbrough (2008), it emerges as "a paradigm with the intention of assuming that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to develop their technology" (p. 1).

Nelson and Winter (1982) pointed out one of the first models that supports the decision by the company in getting new technology outside of its boundaries. This gave rise to studies concerning the importance of investing in R&D (Shumpeter, 1934, 1939; Kline and Rosenberg, 1986; Bouchikhi and Kimberly, 2001), giving special attention to the possibility that these are *two sides of the same coin*: the inside and the outside of the company (Cohen and Levinthal, 1990). Many models have been developed in order to better understand how companies exploit their knowledge and use strategic alliances and networks in their business (Gerlach, 1992; Powell *et al.*, 1996; Nooteboom, 1999).

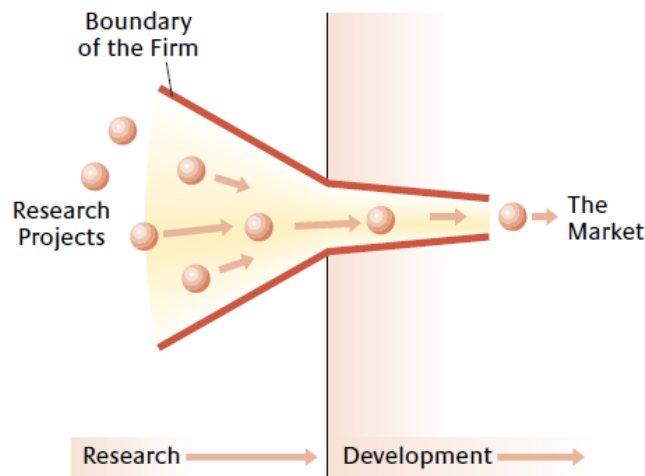
Therefore, this section aims to get to the bottom of and clarify this new concept, to show its critical points and differences with regard to the traditional model. The concepts of Open Innovation (OI) and Closed Innovation (CI) will be clarified, so that the main differences will be highlighted between the two. Lastly, their determinants will be defined to demonstrate its advantages over the traditional model.

2.2. *Closed Innovation and Open Innovation approaches*

In the Closed Model, defined by Chesbrough (2003a) as Closed Innovation (CI), each company creates its own ideas, develops and supports itself. During many years this was a successful strategy for many companies and the best way to introduce new ideas into the market, following an aggressive protection for intellectual property (IP) and by achieving large profits that would lead to more research and more discoveries

(innovation cycle prevalent in the 20th century – Lopes and Teixeira, 2009). Therefore, research projects arise from a science and technology basis of the company, from which later some are selected for further analysis. After which a sample of these will be chosen to enter the market. So, it is classified as "closed", because the projects arrive in one way (by internal search) and may only leave by one way (through the company), reaching the market, as demonstrated in figure 1:

Figure 1 – Closed Innovation Approach



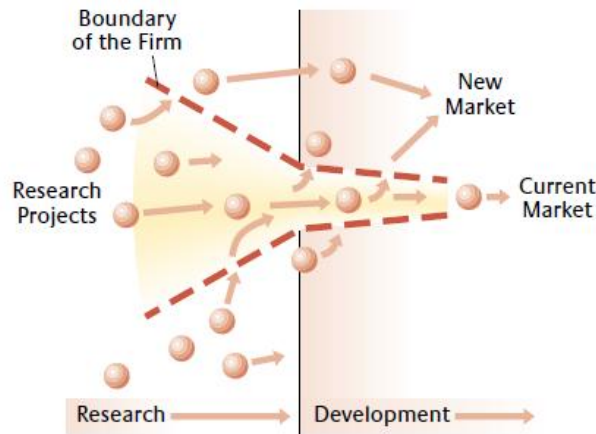
Source: Chesbrough, 2003b

There are several reasons that explain the disappearance of the traditional innovation model, giving rise to the new model of innovation management: increasing technological diversity offered externally (Chesbrough, 2003a; 2004; 2008), the adjustment of the company strategy by considering the acquisition of foreign technology solutions (Chesbrough, 2003a; Chesbrough and Schwartz, 2007; Chesbrough, 2008), the increasing mobility of skilled employees which makes it difficult to have ownership and control of their ideas and knowledge (Smith, 2004; Chesbrough and Schwartz, 2007) and the increasing emergence of private investors who helped fund the creation of startups and, consequently, the exploitation of ideas created in a laboratory research (Chesbrough, 2003a).

Unlike the previous model, in the OI approach, projects can emerge from both internal and external sources and the new technology can be incorporated in several

stages of the development process. Therefore, projects can reach the market in various ways (e.g. by outlicensing or spin-off companies) and also reach through sales channels and the company's internal marketing (Chesbrough, 2008). Therefore, are classified as "open" because there are several ways for the ideas to flow into the process and, subsequently, to flow out, into the market, as shown in figure 2:

Figure 2 - Open Innovation Approach

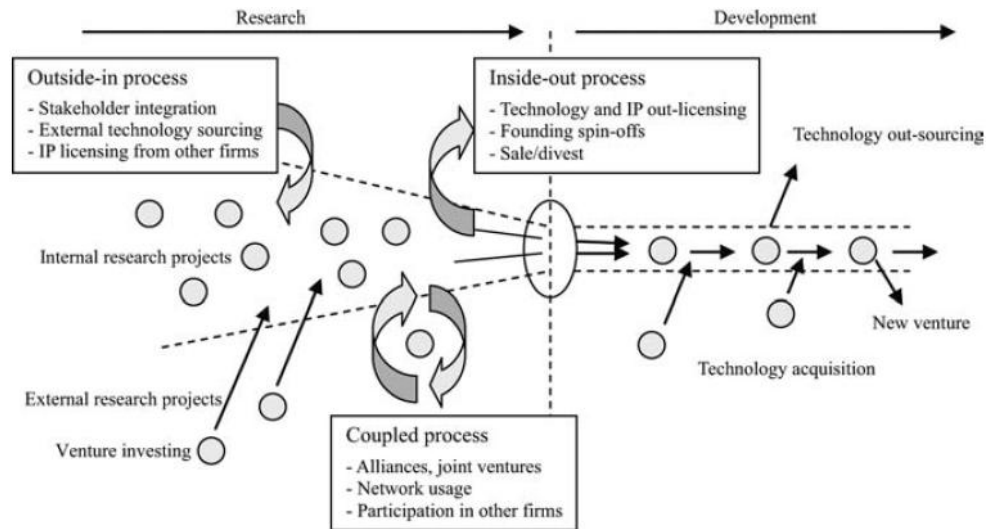


Source: Chesbrough, 2003b

The wall between the company and the surrounding environment is porous, allowing increasing flows of innovation between both. It is, therefore, possible to explore internally the potential of the company and obtain benefits through external knowledge sources – value creation, particularly by marketing the internal ideas through external channels, leading even to the opening of new markets. Hence the concepts of inbound, as regards to the first case, where companies use internally the knowledge acquired externally; and outbound, which regards to the second process translated into internal knowledge exploitation for external use (Huizingh, 2010; Mortara and Minshall, 2011).

Enkel et. al. (2009) introduce a third dimension in OI: coupled process, i.e., a combination of both models (mentioned above) through complementary processes that result in the creation of alliances and/or joint ventures, where the use of networks is essential (Chesbrough and Crowther, 2006), as demonstrated in figure 3:

Figure 3 – Dimensions OI: Inbound, Outbound and Coupled Process



Source: Inauen & Schenker-Wicki (2011)

So it will be interesting to apply to the Portuguese context and corroborate to what extent this new concepts are accepted in the enterprises.

2.3. Distinction between a *Closed* and *Open* approach: synthesis

The concept of OI came up with the amendment in the current cultural concepts, combined with a world that is becoming more globalized and integrated, mainly due to the emergence of concepts like outsourcing, flexibility, agility, internet and information networks (Huizingh, 2010; Jacques Bughin, McKinsey Global Institute, January 2012).

To better understand the introduction of this concept within Portuguese companies is critical to understand the main points of distinction between the Open and the Closed models, summarized in table 1:

Table 1 - Summary table of the differences between Open and Closed Innovation

Closed Innovation	Open Innovation
<ul style="list-style-type: none"> • Closed in the processes – performed only by and for the company itself: mentality "do-it-yourself" (Gassman, 2006) • Create their own ideas, develop and supports them (Chesbrough, 2003a; Chesbrough <i>et al.</i>, 2008) • Controlled innovation with rules (Chesbrough, 2003a) • Substantial investments in internal R&D, in order to create the greatest number of ideas, to be the winners (Chesbrough, 2003b) • Commercialization of foreign technology was more an activity ad-hoc than systematic (Tschirky <i>et al.</i>, 2000) • Hiring the best and brightest to earn rewards in the discovery of the best ideas (Chesbrough, 2003b) • Aggressive protection of intellectual property in order to obtain all of the benefits (Chesbrough, 2003b) • Application of profits in more R&D, leading to more discoveries and ideas (innovation cycle) (Chesbrough, 2003b) 	<ul style="list-style-type: none"> • Open in the processes: inbound or outbound (Chesbrough <i>et al.</i>, 2008) • Creates and sells external and internal ideas, implementing both outside and inside the companies paths to market. (Chesbrough <i>et al.</i>, 2008) • Commercialization of foreign technology generates an economic benefit, as a supplement or substitute (Huizingh, 2010) • Value creation, leads to the creation of new markets (Lopes and Teixeira, 2009) • They don't have to be the creators of the research to profit from it (Lopes e Teixeira, 2009) • Can lead to the establishment of their laboratories outside the company that are merged for commercialization – best use of internal ideas, so that they will be winners (Chesbrough, 2003b) • Use of external intellectual property through licensing agreements, joint ventures or other arrangements (not restricted) and profit from the use of their intellectual property (Bianchi <i>et al.</i>, 2010; Sheehan <i>et al.</i>, 2004) • Numerous external sources of knowledge (Hippel, 1998): suppliers and consumers; universities, Government and private laboratories; competitors; and, other nations.

Source: the author

What table 1 demonstrates is a set of characteristics referred by several authors for each one of the paradigms. What stands out is the fact that in the OI model, unlike the CI model, great importance is given to the use of intellectual property, not only inside the company but also outside their barriers, eliminating several limitations which existed previously. For example, one of these limitations was that R&D would only developed for the company itself, leading to many problems that weren't solved more quickly or even solved if there had been the possibility to use intellectual property already existing outside the company. On the other hand many of these ideas were kept within the company itself, without any use, rather than obtaining returns with its external use.

Therefore, it is important to have a direct contact between different companies, in order to increase the exchange and development of ideas and technologies between the inside and outside of the organization (Chesbrough and Crowther, 2006).

2.4. Determinants of the Open Innovation approach

Through the review of the literature in this area, there seems to be a focus on two important elements: the acquisition and the transference of knowledge/technology to other companies (Enkel et al., 2005; Chesbrough and Crowther, 2005; Lichtenthaler, 2008). This is possible by the licensing of intellectual property (Sheehan et al., 2004), the development of partnerships (Piller and Walcher, 2006; Van der Meer, 2007; Chiaroni et al., 2008; Belussin et al., 2008), the creation of relationships between companies and the scientific and technological systems (Chesbrough, 2003; Harwing, 2004; Blau, 2007; Perkmann and Walsh, 2007; Link et al., 2008), the launch of new spin-off companies and by mergers and acquisitions (Parhankangas et al., 2003). This new approach allows the existence of multiple marketing standards for innovative ideas, which ensures a more appropriate and complete business model (Hoffman and Schlosser, 2001), associated with an aggressiveness of the intervenients (Goffin and Mitchell, 2005) or through a significant reduction of costs in the field of R&D (Gassmann, 2006; Collins, 2006; Chesbrough and Schwartz, 2007) but still maintaining economic growth and the revenues (Chesbrough and Crowther, 2006).

On the other hand, this approach still has some obstacles that have to be overcome, such as the: lack of understanding of a company's practices organizational cultures and bureaucratic elements (Boschma, 2005); limited resources, liberal behaviors, and other specific problems involving the terms of collaboration (Hoffman and Schlosser, 2001; Mohr and Spekman, 1994); and also, the existence of barriers for those adopting OI. For example, a study made by Knudsen and Mortensen (2011) demonstrated that a superior degree of openness can make a product development slower and more expensive when compared with a development internally. On this line of thought, it is important to note the syndrome of Not-Invented-Here (NIH), derived from outside knowledge, research or external products already known and exploited (Katz and Allen, 1982). Table 2 gives an overview of advantages and disadvantages associated with the OI approach:

Table 2 – Advantages and disadvantages of OI approach

Advantages	Disadvantages
Formation of partnerships, which leads to the reduction of wasted time – "Intermediated network model" (Gassmann and Keupp, 2009; Jacobs and Walkens, 2011; Lee <i>et al.</i> , 2010; Piller and Walcher, 2006; Van de Meer, 2007; Chiaroni <i>et al.</i> , 2009; Belussin <i>et al.</i> , 2008)	Existence of costs in the use of external sources of knowledge and intellectual property that negatively affect the reliability of Open Innovation (Lichtenthaler and Ernst, 2009)
Improvement in internal use of creativity (Jacobs e Walkens, 2011; Hadjimanolis, 2006; Heidrick <i>et al.</i> , 2005; Baba <i>et al.</i> , 2009)	Cultural barriers to entry: <ul style="list-style-type: none"> • Syndrome Not-Invented-Here (NIH) (Katz and Allen, 1982) • A free behavior and the rights of intellectual property protection (Hoffman e Schlosser, 2001; Mohr and Soekman, 1994) • Economic, cultural and organizational systems (Boschma, 2005) • Lack of resources (Hoffman and Schlosser, 2001; Mohr and Soekman, 1994)
“Umbrella” that incorporates, connects and integrates a number of existing activities (Huizingh, 2010)	
Openness and encouragement to new developments and rapid commercialization of technology (Huizingh, 2010; Hall <i>et al.</i> , 2003)	
Indirect and pecuniary benefits (Dahalander e Gahann, 2010; Macpherson and Ziolkowski, 2005)	
Reducing costs and risks (Howells, 2008; Hoffman e Schlosser, 2001)	

Use of complementary assets to increase the company's growth and its profits and reduce the uncertainty and technological problems (Howells, 2008; Chesbrough e Crowther, 2006; Hoffman e Schlosser, 2001; Hall <i>et al.</i> , 2003; Heidrick <i>et al.</i> , 2005; Kim and Lee, 2003)	
Increased organizational networks at a nacional and international level (Sáez <i>et al.</i> , 2002; Hadjimanolis, 2006)	

Source: the author

So, what this new paradigm suggests is the creation of new ideas and the growth of their potential marketing, allowing an economic exploitation of the same. Chesbrough and Crowther (2006) observed, in this context, that an inbound effort carried out by one company, by definition, generates a reciprocal outbound effort from another company. In this sense, it's not only implied the concept of creation of value, but also its capture, because the company uses internal technology in their core business (Gann, 2004; Smith, 2004; Blau, 2007), and then licenses or sells its technology/knowledge for external use (Hemphill, 2005) and also underlies the creation of new enterprises that use technology/existing knowledge, but which are on standby, waiting to be used or developed (Alio, 2005; Hemphill, 2005). Thus, the capture of value is a possible justification for the great advance on economic activity of many large companies today, as Procter&Gamble (P&G), IBM, Dell, Breeze, Mota-Engil, among many others (Lopes and Teixeira, 2009). However, empirical studies have demonstrated that companies engage more inbound activities than outbound (Chesbrough and Crowther, 2006; Bianchi et al; Cheng and Huizigh, 2010; Chiaroni et al., 2009) with evidences indicating companies failure with respect to the potential capture of external benefits (Chesbrough, 2003a; Van de Vrande et al., 2009).

Lined up with this concept of capture of value, it is important to clarify one aspect: even if the resources, human or financial, are limited, an idea must be framed with the economic activity, capacity and strategy of the company (Mowery *et al.*, 1996; Granstrand *et al.*, 1997; Bursoni *et al.*, 2001). By submitting an idea, it is authorized the transfer of copyrights and future earnings potential for innovation, leading to the

creation of new products and strategic services for the company. In this sense, it appears that internal capabilities and external relations are complementary and not substitutes (Dahlander and Gann, 2010).

2.5. Implementation of the OI approach

Using the study done by Chiaroni *et al.* (2009), it was possible to obtain a theoretical model that examines the organizational changes occurred within the implementation of the new paradigm. To this effect, there were considered four organizational dimensions that serve as a lever to the OI concept: internal organizational networks, organizational structures, evaluation procedures and knowledge management systems, framed in a context of inbound (outside-in) and outbound (inside-out).

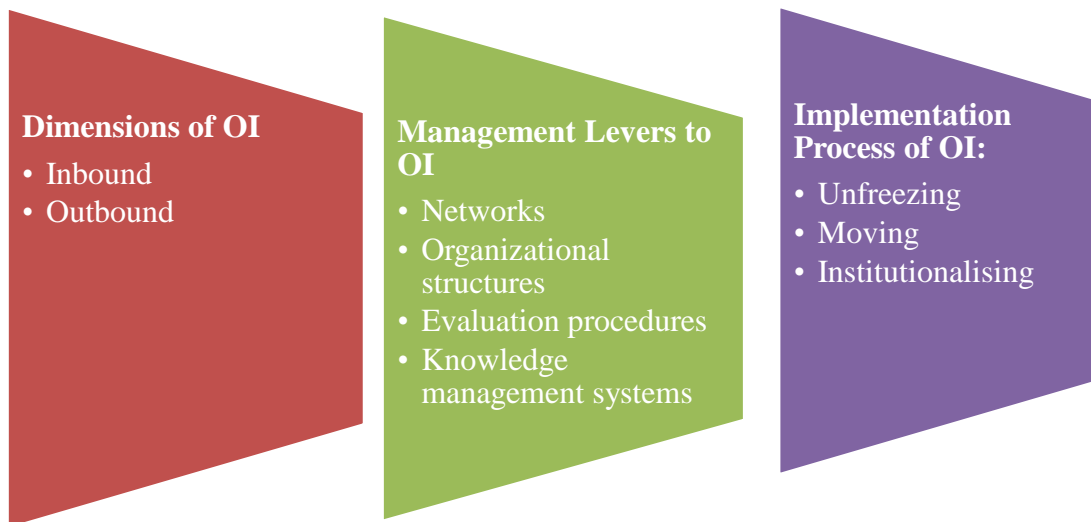
The growing relevance of this paradigm is derived from the existing networks' interests, the emergence of the internet, on the level of professional collaborations and on outsourcing as a way to integrate a set of existing activities (Gassman *et al.*, 2010). Hence, those authors adopted the organizational change model of Lewin's (1947) to reveal the milestones necessary to bring about the transformation from a CI to OI process:

1. *Unfreezing*: creation of a new vision that changes the existing paradigms in the company, accompanied by a push methodology that allows the constant progress of these modifications and, later, a pull methodology that enables to maintaining these changes. At this stage, we have the creation of a guiding coalition that is responsible for shaping the expected behavior of employees (Kotter, 2007);
2. *Moving*: consists in implementing this new vision through new procedures, new values, new behaviors, promoted through processes of identification and incorporation. In other words, it encourages employees to take risks, to stimulate ideas, activities and actions, not usual in the enterprise – performance improvements. At this stage, the leadership, counseling and psychological support are key aspects to success;

3. *Institutionalising*: consolidates the new order in practice, monitoring and controlling all processes, as well as incorporating the new standard behavior through specific mechanisms, to prevent any backward steps.

The Lewin's model was the starting point for this study which Chiaroni *et al.* (2009) considered and represented in Schedule 1:

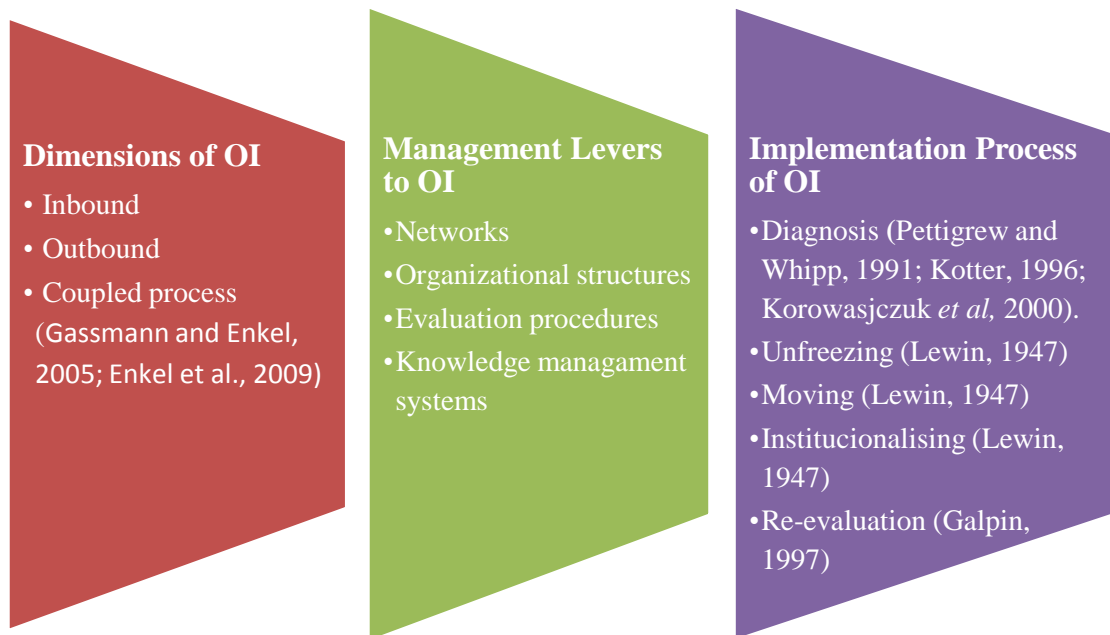
Schema 1 – Theoretical Framework used by Chiaroni et al. (2009)



Source: Chiaroni *et al.* (2009)

However, there are several authors, such as Pettigrew and Whipp (1991), Judson (1991), Kotter (2007), Hussey (1996), Galpin (1997), Clark et al. (1997), Korowasjczuk et al. (2000), Venhaverbeke et al. (2008), among others, who proposed the creation of multistep models of the change process to improve the absorption capacity of a company, a prerequisite fundamental for the existence of OI. Consequently, after analysis of the concepts and milestones proposed by some authors (e.g., Lewin, 1947; Pettigrew and Whipp, 1996; Gassmann and Enkel, 2005), an adjustment of the theoretical framework was made in order to be used as the foundation of all further study, as shown in Schedule 2:

Scheme 2 – Theoretical framework used in this study



Source: the author

So, this reformulation of the theoretical framework considered the third dimension of OI – Coupled Process, explained previously, as proposed by Gassmann and Enkel (2005) and Enkel *et al.*(2009), and also considered two more phases in the implementation process of OI paradigm:

- *Diagnosis*: identify aspects of the organizational culture and leadership styles that are relevant to the concept of efficiency, namely, an assessment of the environment and of the market (crises, threats and opportunities) that can justify, in the future, the creation of a new vision (Whipp and Pettigrew, 1991; Korowasjczuk *et al.*, 2000).
- *Re-evaluation*: be open not only to a change of internal processes, but also the strengthening of the company through new projects, themes, relationships and changing agents (promotions, hires ...) (Galpin, 1997)

In short, what is purposed is a model based on different management levers (networks, organizational structures, evaluation procedures and knowledge management systems) linked to 5 phases of organizational changing process (diagnosis, unfreezing,

moving, institutionalizing and evaluate and invigorate), in order to implement 3 dimensions of OI (inbound, outbound or coupled process).

With the adjustment of the theoretical framework, we are now ready to use it to understand the organizational changes occurred on Portuguese companies in the process of implementation of OI paradigm.

2.6. Conclusion

Chesbrough et al. (2006) identified two different dimensions of the OI model, demonstrating that its practice creates and establishes relationships with external organizations, in order to create opportunities and new ideas. These dimensions are the Inbound and Outbound concepts already explained previously.

Associated with these concepts are the studies carried out by: Chesbrough and Crowther (2006) which demonstrate that in mature and asset-intensive companies, the dimension that predominates is the Inbound; and by Gassmann and Enkel (2005) that demonstrated that in low-tech companies normally prevails an Inbound dimension, while a dimension Outbound is most found in high-tech company.

Additionally was considered another dimension brought by Gassmann and Enkel (2005), the Coupled Process, where there is a combination of both dimensions mentioned above, through complementary processes that result in the creation of alliances and/or joint ventures.

The implementation process of OI lead the companies to take into consideration a certain number of managerial levers: networks, because they are important external sources of knowledge; organizational structures, namely, the need to acquire and integrate the existing external knowledge for company's innovation process (Hansen and Nohria, 2004), being here establish certain rules, hierarchies (Chesbrough and Crowther, 2006) and compensation systems (Chesbrough, 2003a); evaluation processes, that corresponds to the managerial lever by which innovation projects are evaluated,

since the opening of processes increases the technical complexity and uncertainty of the markets (Chesbrough, 2003a); knowledge management systems, which are able to promote the diffusion, sharing and transfer of knowledge created inside and outside the company.

In conclusion, what the OI model offers is the largest opportunity for companies to obtain returns, according to their innovation activities and to the results of their intellectual property. Under a more critical perspective, this paradigm encourages the company to follow different lines of thinking making room for creativity, opportunity, recognition and correlation between different domains. However, there are still many unanswered questions, hesitations and obstacles linked to the choice of this new paradigm, essentially due to concerns over intellectual property rights from CI to OI. It is not enough for companies to limit themselves to the competences that were accumulated year on year.

3. Methodological Considerations

3.1. Initial Considerations

There are different types of contacts that companies could have to power this concept of OI, e.g., universities, customers, suppliers, users and others. However, the purpose of this research project, already pointed out, will be to assess how some Portuguese companies changed their patterns of innovation for a more open process: *how does a company uses different management levers linked to the different phases of the organizational change process to implement each of the dimensions of OI?* In other words, what we intend to investigate is the possible steps in the process of OI implementation, represented by a variety of innovative techniques and styles related to the company structure and that may lead to different results connected with the sharing and diffusion of knowledge. Each company their own perceptions, interpretation and evaluation systems in line with their own expertise (Weick, 1979).

Therefore, in this section we will explore the theoretical framework presented earlier, on which the study sample will be based and this new paradigm. Firstly, it will be specified all points of theoretical framework for further research method and data collection. According to a systematic combining approach, the goal at the end of this section is to consolidate the results obtained from each of the Portuguese enterprises and readjust the theoretical basis set initially.

3.2. Research Method

The study of the research question is based on the analysis of Portuguese companies, and it "investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003). Yin (2003) emphasizes that under these conditions, the strategy is based on a qualitative methodology, that can answer questions like "How?" and "Why?" essentially because there is little knowledge or control over the matter investigated. Since this scenario fits with the existing context of our study, we intend to examine the implementation process of OI in Portuguese enterprises, based on the question "How?",

so we can understand its full impact on the corporate structures. In parallel, we'll also be taken into account secondary data obtained in questionnaires partially used in previous studies.

The main approach of this study will be the systematic combining, which is a "process where the theoretical framework, the empirical work and case analysis are developed simultaneously" (Dubois and Gadde, 2002, p. 554). In other words, the contributions of the theory will be used to build a solid study with greater understanding, since there will be continuing advances and setbacks between the theory and the empirical data obtained in several companies, that we propose to analyze and which will re-enforce each other (Dubois and Araújo, 2004). Therefore, the goal will be to confront all the data, and adjusting, whenever necessary, the theoretical model used.

3.3. Instruments and procedures in collecting data

The study that served us as a starting point for the theoretical analysis belongs to Chiaroni et al. (2009), which performed a detailed investigation of the implementation process of OI on an Italian company, leader in the cement manufacture.

All the information collected for this study was based essentially on direct semi-structured interviews that allowed the understanding and analysis of the stages that the company underwent, from a CI to an OI approach. Other information has been obtained in document form (websites, balance sheets, books, etc.) and files (list of partners, defined objectives, etc.). Subsequently, it was performed a merge of all the information collected (Yin, 2003).

Following the work of Chiaroni *et al.* (2009), this project will also provide information from those in charge of innovation departments and it will evaluate the introduction of this paradigm within a few companies. Therefore, it has the same collecting and processing data, analyzing each company in each step and re-adjusting the theoretical model whenever necessary.

In parallel with this methodology, it is necessary to define what criteria will be used in the selection of companies under review. To this ending, it was considered the study conducted by Lopes and Teixeira (2009) in the determination of the openness degree in some Portuguese companies, linked to the COTEC Portugal – Business Association for the promotion of innovation and increased competitiveness of Portuguese companies - and INESC Porto - Instituto de Engenharia de Sistemas e Computadores do Porto seeking the technological R&D, as well as contributing to the development and sharing of new knowledge and creating new companies -, as shown in the table 4:

Table 4 – Categorization of companies by business sector

Manufacturing Industry		Services	
Business Sector	Companies	Business Sector	Companies
Industrial and commercial machinery and IT equipment	RTL	Services provided to companies	Oracle
Construction and Engineering	Mota-Engil		Prosegur
	Ensul Meci		Sistrade
Basic Metallurgical Industry	Metalocar		Wedo Technologies
Production and distribution of electrical energy	Tejo Energias	Communication	CTT
	EDP Inovação		Estoril Sol III
Equipment for energy production	Martifer		PT Inovação
Footwear Industry	Aerosoles	Operation and maintenance of transport infrastructure	Brisa Inovação e Tecnologia
Furniture and their characteristics	Vicaima		
Production of moulds	SET (Iberomoldes)		

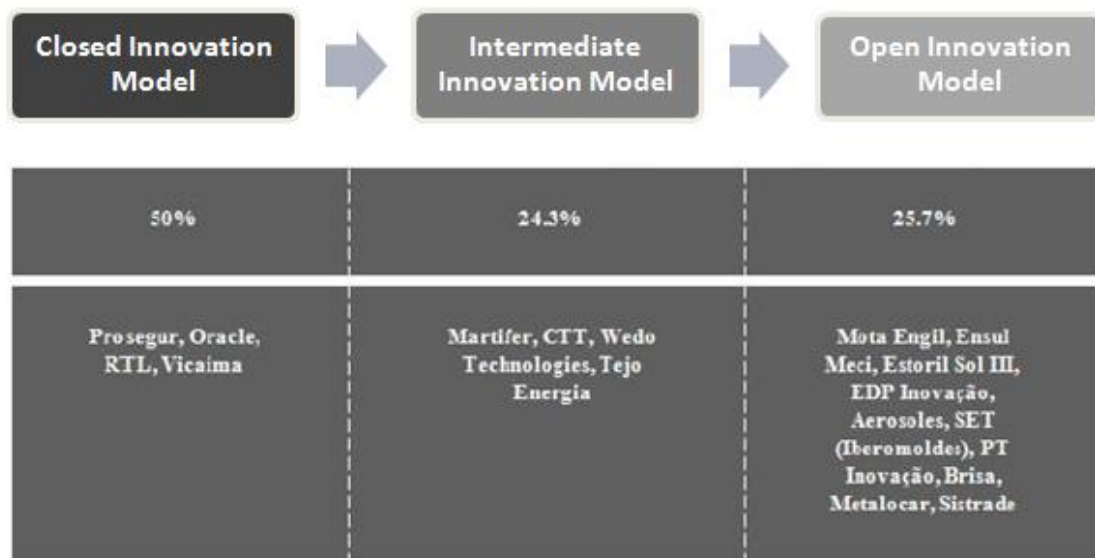
Source: Lopes & Teixeira, 2009

The analysis performed for this sample was carried out according to certain parameters, such as: structural variables, industry to which they belong, intensity of human capital, innovation and foreign trade.

The final results of this study demonstrate the degree of openness of each of the companies. Not only in the absorption perspective of external knowledge and

technologies, but also in the transference to other organizations, as represented in table 5:

Table 5 – Index on the use and transfer of knowledge and technology



Source: Lopes & Teixeira, 2009

Following this study, it was exposed that according to the degree of openness of the companies in the sample, is possible to find both perspectives.

Thus, it appears that the company's innovation process depends on a constant observation of processes related to existing technologies in the incumbent and emerging market, in order to predict new trends, coupled with a constant management of interfaces and strong collaborations with the exterior, allowing the creation of strategic lines intertwined with the innovative activities developed. There is here a difference in the existing perception of companies as a simple and affordable process or, in turn, as a complex and problematic process.

From the results, there are ten companies found to be open innovators, involving all the changes that this entailed in their structure and strategy: Mota-Engil, Ensul Meci, Estoril Sol III, EDP Inovação, Aerosoles, SET (Iberomoldes), PT Inovação, Brisa, Metalocar and Sistrade. Therefore, the collection of information was limited to these companies, with contact being made with the managers (direct interviews) and

secondary data obtained by other similar studies performed both inside and outside of Portugal.

However, we considered another company as an open innovator, in order to understand the OI approach in a low-tech company, contrary to what is depicted in the sample chosen by Lopes and Teixeira (2009): the Viarco company. In this way, we will try to understand what OI dimension is associated to each company and compare it with the research carried out by Chesbrough and Crowther (2006) and Gassmann and Enkel (2005). This company will be analyzed in accordance with the defined methodology.

Depending on the research question presented, the methodology was mainly qualitative, primarily through the data obtained, via interviews, according to the following steps:

1. A brief description of the research project in written form or by phone
2. Contact with the heads of the departments of R&D and innovation, as well as other employees
3. Individual semi-structured interviews with each of the heads of departments, recorded and transcribed in its total, followed by a set of open questions previously elaborated and articulated
4. Completed with information taken from documents and articles published (bibliographic search, *sites*), as well as internal documents of the company that can demonstrate and substantiate the evolutionary origins and developments so far.

This will provide a more complete and diverse amount of information, allowing a more complex database with more robust conclusions. In accordance with the systematic combining approach, the target will be, after each company analysis, to consolidate all the results, so that in a critical point review of the theoretical framework, will enable the identification of any potential adjustments (Pero *et al.*, 2010).

3.4. The sample selected

According to what has been stated above and on the diverse literature referred (e.g., Golden, 2000; Ball, 2004; Smith, 2004; Gann, 2004; Gali, 2005; West, 2005; Helfat and Quinn, 2006; Hemphill, 2005; Chesbrough and Schwartz, 2007), there is a range of industries transitioning from a closed innovation to an open innovation model, covering various activity sectors. Allowing collaboration between companies makes it possible the creation of networks with several types of persons or entities and, consequently, solves problems or difficulties through external solutions (Canas et al, 2006).

The research project produced by Lopes & Teixeira (2009) was fundamental for this study, where there was considered some Portuguese companies already framed on the OI concept and which had a percentage of use and transfer of knowledge and technology of 25.7%.

Nine companies were contacted (one has closed), but only four companies of this sample will be highlighted and their analysis will be further developed on the context of OI implementation concept: PT Inovação, Mota-Engil, Brisa e EDP Inovação. In this sense, first, it will be made a brief presentation of each these companies, as well as a summary table with their main features.

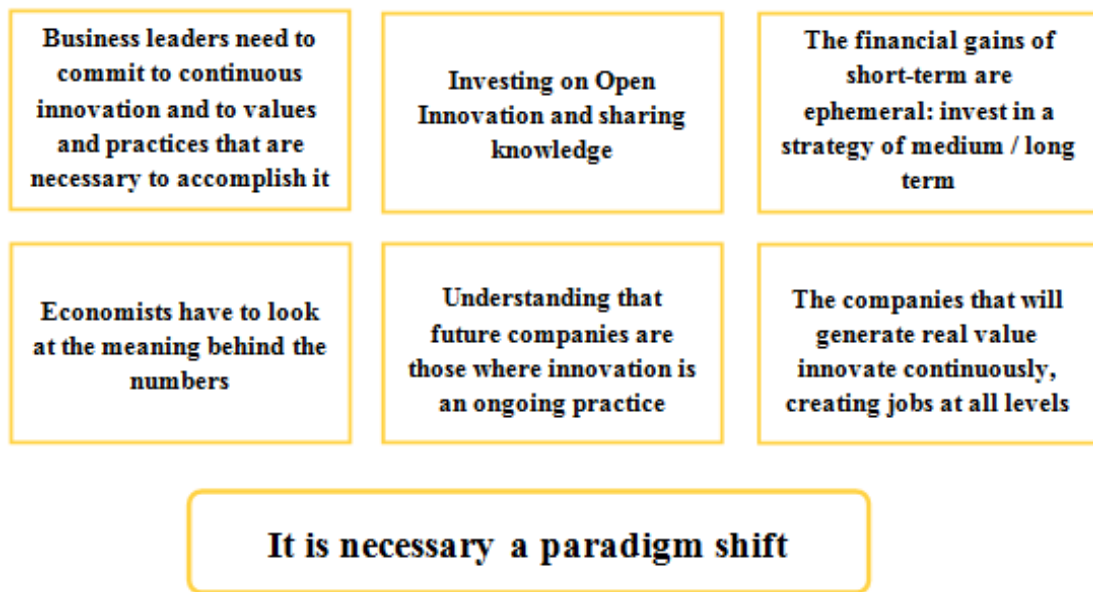
PT Inovação arose from the need to ensure technologic success of telecommunications, within an innovation knowledge standpoint of the Portugal Telecom Group. Established since 1999, it offers to create conditions necessary for the development of new products and processes in new markets, combined with the idea of innovation, value creation and knowledge acquisition. This enterprise relies on the conception of ideas developed by their employees, and on encouraging and recognizing their work. PT Inovação provides services to the subsidiaries by the Portugal Telecom Group, through the search for answers to the challenges presented, with the goal of creating competitive advantages for companies within the Group. In this case, the contact was established with Marcelino Pousa, responsible for the management support, innovation and knowledge of the Group.

Meanwhile, Mota-Engil was founded in 1946 by Manuel António da Mota, and was first known, as Mota & Companhia. The analysis of the group evolutionary history, reveals a path of more than 60 years dedicated to the development of new projects, imbued with a strong investment capacity, versatility and entrepreneurship, that mark out Mota-Engil as one of the leading companies in the construction sector (in Mota-Engil site, in an interview with António Ruivo Meireles, 2012), both in Portugal and on the international arena.

Regarding to the structure, the Mota-Engil Group is comprised of three major business areas: Engineering and Construction, Environment and Services, and Concessions and Transport. In this company, the contact was established with António Ruivo Meireles, coordinator of the department of Innovation.

In a separate sector, there is the Brisa Group, founded in 1972 and currently recognized as "one of the largest operators of toll highways in the world and the largest transport infrastructure in Portugal" (in Brisa web-site). Its main economic activity is the construction and exploration of road infrastructure and it is established in a very peculiar market, as will be shown later. The company Brisa Inovação e Tecnologia (BIT), framed in the Brisa Group, was established in 2009 and results from the merger of two business areas: the department of Innovation and Technology with the Brisa's department of Electronics Equipments. Essentially, the aim of BIT is the provision of technological solutions for the levy and highways map (interview with Tomé Canas), enabling the most effective implementation of intelligent transportation systems (ITS) for its customers, whether it is provided by Brisa or external resources. Therefore, BIT is based on the principle of value creation for the entire chain, by maximizing and extending the existing knowledge through innovative and efficient ways, as shown in Scheme 3:

Scheme 3 – Paradigm shift adopted by BIT



Source: Information courtesy by Brisa Inovação e Tecnologia (BIT)

Our contact in this company was the Tomé Canas, responsible for the development of new products in Brisa Group.

Lastly, the EDP Group, formed in 1976 by the merger of 13 distinct companies, nationalized in the year before. In the following years, the company expanded and restructured itself, becoming nowadays, a leading company in the energy sector and occupying the 280th place among the largest companies in the world. Promoter of concepts such as value creation, strategy, sustainability and innovation, it led to the creation of the EDP Inovação in 2007, whose main function is reflected in the production of innovation for the Group itself, "building bridges with all businesses and landscapes, reusing what is done well on one side to improve the other side "(interview with Venceslau Parreira). Thus, EDP Inovação is a company that promotes sharing and adoption of new knowledge and technologies through the exchange of alliances, and facilitating access to innovative technologies, under the "Clean Energy Technologies." In this case, the contact was established with Venceslau Parreira, head of the department of Innovation of the Group.

In order to better understand the impact of the OI concept in Portugal, we've searched for a company which has been established in the market for a longer time and with a completely different business sector of those chosen by the Lopes and Teixeira study (2009), i.e., a company that was not linked to the technological aspect. Therefore, it was added to the sample the Viarco company, whose economic activity is focused on the production and marketing of pencil. In this company the contact was established with José Vieira, manager of the company.

In table 6 is presented a summary of the information collected from the internet and the companies mentioned above:

Table 6 – Summary table of the Portuguese companies

	Economic activity	Creation Date	Mission/ Goals	Principles
Viarco	Production and commercialization of pencils	1936	<ul style="list-style-type: none"> • Research and development of equipment and methods of production that have improved the quality of products and diversify the offer; • Recovery of the building and construction of the pencil Museum 	<ul style="list-style-type: none"> • Promotion and development of new products; • Creating partnerships and capturing interest on the part of the whole community
PT Inovação	Pursuit of technological development of telecommunications	1999	Promoting the Group innovation through dissemination of knowledge, but remaining competitive in the national and international markets	<ul style="list-style-type: none"> • Criativity and Innovation • Learning by doing • Team work • Effort Customer satisfaction

Mota-Engil	Construction and engineering services	1946	Promotion and development of initiatives that values the Group, taking into account the community and the surroundings	<ul style="list-style-type: none"> • Social responsibility • Entrepreneurship • Sustainability • Internationalization • Competency and Accuracy
Brisa Inovação e Tecnologia	Continuing technological advances in road infrastructure	2009	Promoting the development and creation of technological solutions at the Intelligent Transportation Systems - ITS	<ul style="list-style-type: none"> • Efficiency • Innovation and Development • Cooperation and internal/external Collaboration • Sustainability • Value creation
EDP Inovação	Pursuit of technological advances in energy field	2007	Promotion and development of new technologies that create value for EDP Group	<ul style="list-style-type: none"> • Sustained Growth • Efficiency • Innovation and Development • Controlled Risk

Source: information collected in the respective companies' websites and interviews

Viarco is currently the only pencil factory in the Iberian Peninsula. It houses a large collection of industrial archaeology, as stated by José Vieira (Viarco Manager), and includes consequently the company in the industry tourist circuits.

With a centenary history, Viarco is a company that has survived to the successive technological advances and learned how to deal with the diverse problems emerging in the market. So, it is important to understand how the company has been able to resist all these years and what kind of innovations it had to undergo. The current economic situation added to a dysfunctional factory, with old equipment, a team "stopped in time" and a lack of financial resources, pushed the company to a creative and innovative path. Therefore, in one hand, there were created research departments open to any person,

internal or external to the company, willing to develop new ideas and new materials associated to its business. In the other hand, there were also created cooperation networks with other organizations, i.e., creation of custom pencils to other enterprises. As a result, the company's acquired new concepts and strategies that allowed them to settle a position on the market.

3.5. Conclusion

According to the proposition under investigation, the methodology chosen for this project was a Systematic Combining (Dubois and Gadde, 2002), together with an analysis of the semi structured interviews made to each company, in order to understand the introduction process of the OI concept within Portuguese companies.

Following the work of Lopes and Texeira (2009), it was possible to identify which companies were considered open innovators, obtaining a final sample of five companies: PT Inovação, Mota-Engil, BIT, EDP Inovação e Viarco, each one framed in their own business activity.

In conclusion, in terms of economic activity, is well reflected the diversity within the chosen sample, including high-tech and low-tech companies on the same sample. In general, the impact demonstrated by each of these companies in adherence to the OI concept resulted in a reduction of costs at the structural level and an increase of quality and innovative solutions, from inside and outside the company.

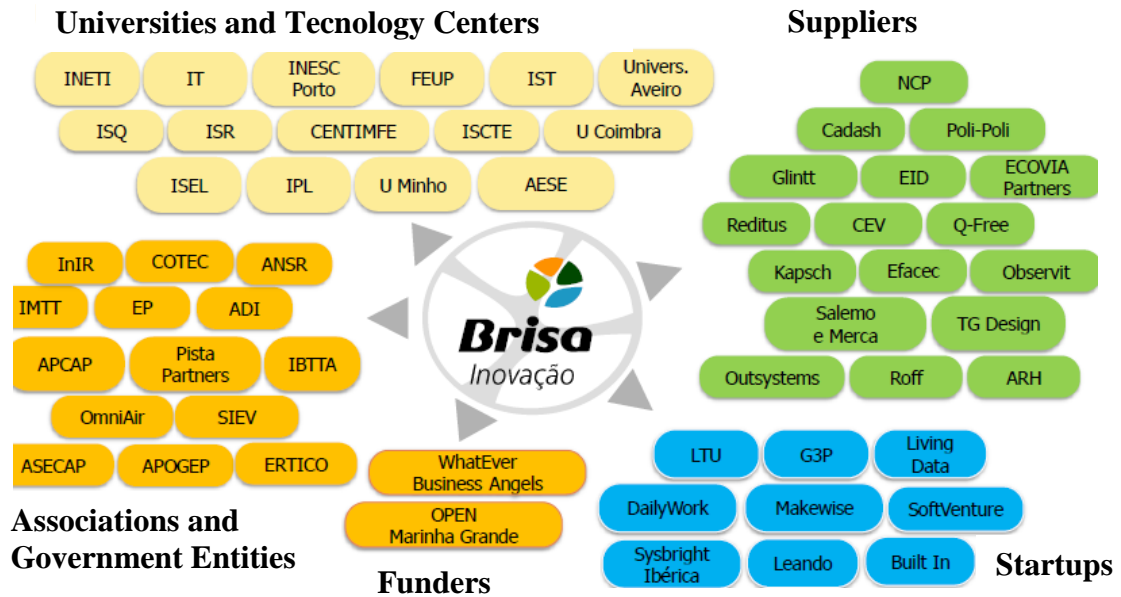
4. Results and Impacts

Based on the interviews and projects submitted by each of these companies, clearly it is detected the presence of OI concept, enabling the creation of new challenges and new partnerships in the near future, pointed in the next paragraphs.

By confirming the presence of the three dimensions belonging to the OI concept - first aspect shown in the theoretical model definition - it can be seen, initially, the introduction of each company in a OI Inbound dimension, which is the use of internal knowledge acquired by entities outside the company, mainly due to partnerships with universities. Only at a later stage, we can see the presence of OI Outbound dimension, i.e., exploration of internal knowledge for external use (Huizingh, 2010). This is consistent with the evidence presented by some authors, as Chesbrough and Crowther, 2006, Bianchi *et al*, Cheng and Huizigh, 2010; Chiaroni *et al.*, 2010. Moreover, there is a growing presence of each company in a Coupled dimension, as it is shown by the presence a revolutionary process in knowledge and innovation management: the digital platforms (Mota-Engil, PT Inovação and EDP Inovação) where there is an encouragement on the participation of several kinds of entities in the discussion of problems, allowing the flow of information and knowledge to both sides, as defined by Gassmann and Enkel (2005), and in different perspectives.

In what regards to the managerial levers, specifically the Brisa Inovação e Tecnologia company, has the ambition to improve the response to market needs, focusing on knowledge sharing centered on the perspective of the OI model, betting on company's existing human capital along with a collaboration policy with network interfaces and, finally, in the possibility of a sustainable global economic development. In this case, a significant part of solutions developed was achieved largely through partnerships developed in the context of this concept with the universities, becoming a process that quickly extended to the rest of the value chain, as shown in figure 4:

Figure 4 – Network of relations of BIT



Source: information collected in the respective companies' websites and interviews

At the same time, all the companies studied demonstrated a monitoring procedure in what regard to the implementation of the OI model, adjusting its internal culture and trying to minimize any obstacle in the process of change, especially with the employees.

Through in deep analyses of interviews, we've tried to frame the companies sample in an OI dimension. Thus, we've concluded that, although initially all businesses have a higher percentage of Inbound activities (Outside-In) than Outbound activities (Inside-Out), as is the case of the resource to Universities, later there are modifications.

In this sense, to analyze the PT Comunicações, we've confirmed a strong link to the industry through European research projects, i.e., research and monitoring of new telecommunications technologies for further internationalization of the final product. Therefore, the entire research and innovation are carried out within the company itself. Only in a development phase, they use external partners to solve the existing problems. In this sense, we find a more active presence of the Outbound dimension. In this case we can even find some cases where there is a technology licensing concerning to the exterior companies.

In the EDP Inovação case, we can find some interesting peculiarities, such as being the first company in Portugal to create a FABULAB by Venceslau Parreira, a concept that will be developed here in below. It is a solution that is open to the whole community in order to each one leave its know-how and expertise, so the company can apply internally and, at the same time, leave the knowledge for those who will come later. In addition, the company also developed a digital platform, the Co-Creation (www.cocreation.pt), which encourages the sharing of knowledge in both directions. In this sense, we can find a more active presence of a Coupled dimension.

In the Viarco case, we have found a similar situation to the EDP Inovação, i.e., an available space in the factory was being used for the creation of innovation ateliers that work within a similar perspective of the FABULAB concept. The ateliers are open to the whole community, where they can test materials and develop ideas, experience and validate a product, and also create new proposals and new projects. These concepts have a significant importance in the designing of communication and influence networks, serving once again, as an active presence of Coupled activities.

In the case of Mota-Engil, we also have noticed an active presence of the Coupled dimension. For example, it is being developed, to start this year, an open channel to discuss and solve problems of the construction and engineering branch from external entities, i.e., it can solve not only internal problems, but as well, discuss problems exposed by other organizations. In addition, the company Mota-Engil has also been supporting the creation and development of new businesses, which in most cases, arise from existing relationships with universities.

Finally, with regard to the BIT, alike PT Innovation, research is also done internally. Only at the stage of product development is that BIT appeals directly to a chosen external entity (universities or companies), creating mixed teams for the development of the entire project. As in the Mota-Engil, BIT also supports some Startups in their development and, once again, the majority comes from existing relationships with universities. Additionally, there is a strong interest in the creation of technology licensing to external entities, such has happened this year between BIT and an external

company. Therefore, we came across with an active presence of an Outbound dimension.

In order to apply the theoretical model in more detail, table 7 presents a brief framework of each these companies in the five stages of the organizational changing process to implement the OI concept, being subsequently presented the difficulties experienced in each of the steps, according to table 8:


Table 7 – Implementation process of OI model

	Diagnosis	Unfreezing	Moving	Institucionalising	Re-evaluation
PT Inovação	<ul style="list-style-type: none"> • There was not a defining moment • Opening to the concept due to lack of internal capacity self-sufficient 	<ul style="list-style-type: none"> • Need for internal change of mentalities • Collaborations with universities • Monitoring of external knowledge 	<ul style="list-style-type: none"> • Enlargement of the network to companies, European research projects, clients, forums • Collaboration of people in an outsourcing basis 	<ul style="list-style-type: none"> • Creation of a virtual platform (in testing phase) 	-
Mota-Engil	<ul style="list-style-type: none"> • Evolution of the sector that led to the adherence to the concept (beginning approx. in 2003) • Gradual process still under development 	<ul style="list-style-type: none"> • Need for internal change of mentalities • Constant contacts with universities and national and international entities 	<ul style="list-style-type: none"> • Development of several projects in partnership • Interest from various entities for the learning process of introducing the concept of OI 	<ul style="list-style-type: none"> • Development of virtual platform (InnovCenter), forum and website • Creation of mixed teams 	<ul style="list-style-type: none"> • Possibility to develop new initiatives for collaboration to other entities • Support in creation of Startups;
Brisa Inovação e Tecnologia	<ul style="list-style-type: none"> • Adherence to the concept in 2002 • Opening to the concept due to lack of internal capacity self-sufficient 	<ul style="list-style-type: none"> • Alliance with partners with technology solutions, startups and universities; • Separation of the functions of each network element 	<ul style="list-style-type: none"> • Encouragement on research to universities • Placement of challenges directly to the intended entity • Direct contacts with the involved entities 	<ul style="list-style-type: none"> • Creation of mixed teams, completing the circuit always in Brisa; • Existence of active patents and licensing 	<ul style="list-style-type: none"> • Long-term protocols with Universities and companies; • Support in the creation of Startups;

EDP Inovação	<ul style="list-style-type: none"> • Evolution of the sector that led to the adherence to the concept • Gradual and iterative process 	<ul style="list-style-type: none"> • Transition to a horizontal company type and with a new culture of collaboration; • Interconnections with the whole community: universities ... 	<ul style="list-style-type: none"> • Existence of <i>Prosumidores</i>; • Creation of incentives to creativity in the form of awards 	<ul style="list-style-type: none"> • Development of virtual platform (Co-Creation) and other collaborative tools, e.g., website and FABLAB; • Use of specific licensing and patents 	<ul style="list-style-type: none"> • Social innovation initiatives with the involvement of the entire community
Viarco	<ul style="list-style-type: none"> • Adherence to the concept in 2006/2007 • Opening to the concept due to lack of internal capacity (creativity) 	<ul style="list-style-type: none"> • Need for internal change of mentalities • Creation of networks of communication and influence, through an information by word of mouth 	<ul style="list-style-type: none"> • Collaborations with more universities and other entities 	<ul style="list-style-type: none"> • Creation of areas in the company to allow artists of any kind to explore ideas and materials 	

Source: the author

Table 8 – Facilities or difficulties experienced during the process

					
	Diagnosis	Unfreezing	Moving	Institucionalising	Re-evaluation
PT Inovação			<ul style="list-style-type: none"> • Facility: existing data base query 		
Mota-Engil	<ul style="list-style-type: none"> • Facility: Full support of the administration in internal sponsorship and introduction of the concept 	<ul style="list-style-type: none"> • Difficulties: distinct objectives between the company and universities; internal culture and fear of giving ideas; large percentage of colleagues adverse to new technologies, need time to mature ideas, economic crisis • Facility: division of associated costs 	<ul style="list-style-type: none"> • Difficulty: find companies that want to innovate and not just sell; technological constraints in projects abroad; low flow of external ideas for the company • Facility: higher percentage of answers and solutions to problems posed to the outside 		
Brisa Inovação e Tecnologia	<ul style="list-style-type: none"> • Facility: entry of a new president in BIT - Engineer Jorge Sales Gomes 	<ul style="list-style-type: none"> • Difficulty: economic crisis; distinct objectives between the company and universities 			

		<ul style="list-style-type: none"> • Facility: acceptance by employees due to the associated benefits 			
EDP Inovação	<ul style="list-style-type: none"> • Facility: rapid evolution of the sector 	Facility: The issue of energy efficiency due to economic crisis	<ul style="list-style-type: none"> • Facility: incentives through awards 		
Viarco	<ul style="list-style-type: none"> • Difficulty: dysfunctional factory and old equipment 	<ul style="list-style-type: none"> • Difficulties: economic crisis; internal culture 	<ul style="list-style-type: none"> • Facilities: motivated internal personal; high adherence from outside to the concept 		

Source: the author

4.1. Diagnosis

The introduction of OI concept in Portugal has come due to the different needs perceived by these companies: needs by choice or necessity, as shown in the first stage represented in table 7, the Diagnosis. At this stage, we tried to understand what was the moment when there was a decision to introduce this concept within the Portuguese companies. According to PT Inovação and EDP Inovação there was not a specific moment of adherence to the concept, since it is a gradual and interactive process. In opposition are the remaining companies that have a specific time for the OI implementation process associated with different justifications.

At this stage and for these companies, it was very important having the full support and understanding of the Administration throughout the implementation process, especially in what regards to the change of the internal culture and mentalities, as mentioned in the interviews, specifically, by Mota-Engil and BIT. In the case of Viarco, the association of a dysfunctional factory, old equipment and limited financial resources, together with a difficult opening minds process in some employees, made it even more difficult when compared with the others examples.

Following this, the way to overcome the limitations felt internally by each company - partly related to economic crisis that marked the last decade and the need to increase the number of projects with lower operating costs - was initially the number of links with universities and, subsequently, the cooperation of companies with common goals, obtaining external resources flexibility. This is consistent with the analysis of motives made by Chesbrough and Crowther (2006), which shows that the acquisition for external resources is critical to maintain the growth and success of the company.

4.2. Unfreezing

The creation of the new paradigm within an enterprise, the unfreezing stage, means that they are willing to seek and create collaborative networks and alliances with various entities. Initially, these coalitions are primarily with universities, being

monitored, at the same time, the existing foreign knowledge. All of the companies in the sample have constant links with universities and there are even defined protocols that regulate the projects developed, as indicated by BIT e PT Inovação.

However, a difficulty present in this stage of the OI implementation process is the fear of internal employees to give their ideas without being rejected by their peers or even their need of time to mature ideas, as shown by the Mota-Engil. In other cases, like Viarco and Mota-Engil, it was possible to verify a large percentage of members who are adverse to technologies and with a *closed mind*. In contrast, cases of BIT and EDP Innovation demonstrated that there were no problems in the introduction of this concept by their employees. Is exactly the opposite, because they realize the benefits that exist in the adherence to this paradigm.

Another difficulty experienced is related to the fact that there are different objectives between universities and companies, shown by Mota-Engil and BIT. In the first case the main purpose is the scientific research that is often not applicable in practice, whereas in the second case it is the pursuit of profit, success and maintains the product on the market. However, in the case of Mota-Engil, there has been an approach of goals, since the current economic situation also require universities to increase their revenue.

4.3. Moving

In order to overcome the difficulties mentioned above, regarding to the objectives between universities and companies, in the next step, the Moving, many of these companies have sought collaborations with entities other than universities. However, it became necessary to find organizations that wouldn't want to just sell their already existing products, but also had the ambition to seek new opportunities and remain competitive and commercially sustainable.

In this way, they have expanded their collaboration networks and attributed incentives for the creation of new ideas and experimentation of new technologies and knowledge, i.e., the creation of new values, motivating the company employees to take

more risks. In the specific case of EDP Inovação, we have the emergence of *Prosumers*, i.e., people that consume energy but, at the same time, produce it in their homes to sell it later.

Taking into account the difficult world economic situation, companies have been reducing their human resources and, consequently, the time available for the creativity of its employees. In this way, Mota-Engil has implemented a system of creativity, meetings where employees, for a few hours, stop thinking in work, relaxing their minds from thoughts of everyday life and focusing their attention on opportunities, problems and innovative solutions for the company. On the other hand, there are companies, like EDP Inovação that focuses on creating incentives for creativity in the form of awards. In a different perspective is the case of PT Inovação with collaboration of people in as outsourcing basis.

At this point, it is possible to analyze the flow of information between the company and the outside world and observe a several developed and in developing projects under the umbrella of the OI concept. For example, Mota-Engil is developing a project together with ANA (airports), Sonae and RAR, in order to develop a methodology to assess accurately the return that a technology can have in terms of innovation. Another case is the creation of a digital platform that is linked to the production by the Mota-Engil and other dynamic companies, such as Teixeira Duarte, among others, to increase competitiveness and support the internationalization of Portuguese companies. In the case of BIT, they have the development of automatic payment machines by notes, in cooperation with the Metalomecânica company. EDP Inovação has developed projects in the area of the Cleantec in partnership with Portuguese and foreign companies. Viarco has been carrying out several collaborations with organizations or even singular artists, creating segments that, at first glance, may not seem useful to the company, but which enable them to have an image on the market: it is the example of the color scheme to help colorblind people.

However, one of the difficulties that are felt is the existing low flow of external ideas, sent by their own initiative, and which may be applicable for the company, as

explained by Mota-Engil and Viarco. Although there is the possibility of creating a partnership with a certain specific entity, exposing then the problem and obtaining the possible solutions, the same does not happen in reverse, i.e., ideas do not arise in the absence of a specific problem.

Considering the case of EDP Inovação in the OI model, it was found the existence of three strands with different ranges serving, however, as a connection to the exterior. In one strand, there is a team that works with all EDP departments where there may be technological innovations, making then a bridge between the interior and exterior and working as booster of new knowledge and technologies. A second strand, refers to a passage from a vertical to a horizontal enterprise, where there is a notion of how to act and change the company culture through synergies between several business areas, with recourse to the use of collaborative tools (Web 2.0). This idea leads to innovation and "lets you leverage the innovation processes in a more effective" way (interview with Venceslau Parreira). At last, in the third strand, the company has a budget based on a venture capital fund, so that it is possible to invest in important projects that are interesting and taking part in enabling the company to develop a centre of innovative technologies for business in various parts of the globe "(interview with Venceslau Parreira).

4.4. Institucionalising

For the consolidation of this new paradigm, almost all companies have created a collaborative digital platform, where it is encouraged the participation by all in the management and discussion of problems.

In the Mota-Engil case, it was decided to decentralize the internal process and encourage the participation of all employees in developing projects, creating for this purpose the digital platform INNOVCENTER. In practice, those responsible for areas, buildings and departments of the company, work together all the information, in any part of the world and at any time, and provide the knowledge in the digital platform to other colleagues, encouraging the participation of all in the Administration and

discussion of problems. Currently, this platform is considered one of the 10 best intranet platforms in the world, according to Nielsen Norman Group.

Recently, this tool was extended to the concept of OI, opening to the outside and where they will be placed and local challenges of interaction between different actors. There are several organizations interested in implementing this innovation in their own enterprise, trying to understand how it was implemented and how is its management, even for giving new solutions and new ideas.

EDP Inovação has also created a digital platform, the Co-Creation, which features two fundamental aspects: one related to *crowdsourcing* and open innovation, exposing the most relevant projects to the community in the attempt of capturing new solutions or approaches through challenges; a second one turned more to innovation, by creating a social network that enables the emergence of discussions between the community and, in this way, the extraction of useful ideas and new solutions for the enterprise.

In the particular case of Viarco and BIT, contrary to other companies in the study, the digital platforms are not used because they lack applicability on their field of business.

Another example included in OI model and introduced by EDP Innovation, in 2010, is the FABULAB (www.fabulabedp.edp.pt) which, as the name indicates, consists of a laboratory where any company or citizen can turn an idea into an object in 3'D, leaving, at the same time the know-how developed for the next customers. Yet within this concept of FABULAB we can find another interesting aspect, an electronic laboratory, i.e., a virtual laboratory with the same concept, linked to the sense of open source and where it is possible to put a challenge to the community to be developed. Through FABULAB, EDP Inovação has achieved much success and positive feedback.

In the same line of thought, we have the Viarco case which has created areas within the own factory for the designing of new ideas and exploration of materials by any artist that wishes to do so. In this way, it creates benefits for both sides in developing ideas and knowledge creation.

At this stage, we find the presence of licensing and patents for some of the companies chosen, as is the case of EDP and BIT Inovação.

4.5. Re-evaluation

On the last stage, Re-evaluation, for example, in the particular case of EDP Innovation we note the creation of new projects under this paradigm: social innovation projects that require the community involvement, in order to choose the best resolutions and minimize the impacts and also to establish stronger links with its citizens. Additionally, some of the projects give rise to a new company which, although linked to the incumbent company in research projects, they have their own standards, purposes and independence. The Mota-Engil and BIT companies are examples that support the creation and development of Startups that have arisen from the existing relationships with universities.

It is important to underline that in all companies in the study, the OI implementation process is still under development and therefore the latter stages are slightly diffuse and more difficult to analyze.

4.6. Conclusion

It turns out that the company's innovation process is dependent on a constant observation of the entire dynamic between the company itself and the external environment, with regard to existing knowledge in the incumbent and emerging market, in order to predict new trends and new opportunities. As far as practical implications are concerned, we observe that this will allow the creation of strategic lines and collaboration networks that lead the company to explore new procedures, new projects and a new attitude.

In conclusion, we identify the existence of five gradual steps in the implementation process of the OI model in Portuguese companies, although few of them have reached the last two phases and those that did still with a low development.

5. Conclusion

This project attempts to understand the introduction of the Open Innovation concept in the organizational and managerial systems of a company, representing one way to systematically analyze how mature and asset-intensive Portuguese companies have implemented this concept. For this purpose, the project first summarizes the existing literature, in order to make possible the development of a theoretical framework with contributions from different authors and streams of research. In this sense, the framework enabled the identification of the stages that each company relied for the gradual implementation of this paradigm. In order to obtain suitable results, methodological tools were used for the study – a qualitative methodology complemented with information given by companies and also collected in previous studies.

The term Open Innovation is relatively recent (Chesbrough, 2003a) and new research is still emerging, especially in what regards to the Portuguese scenario. Therefore, based on the study prepared by Chiaroni *et al.* (2009), it was created a theoretical framework that could allow the analysis of the existing stages in the implementation process of this paradigm. This process has its starting point in management levers, namely organizational structures, allowing a change of mentality and *status quo* of the company, as stated by Chiaroni *et al.* (2009). Additionally, throughout this project, we can perceive the importance given to the creation of relationships and networks by each company and also to the development and adaptation of these possible changes.

Using bibliographic analysis and information collected from all interviews performed to five selected companies, we've found out that among the companies, it is possible to verify the existence of three OI dimensions, although some with a more active presence than others. In the first steps of this concept, we have found a higher percentage of Inbound activities (Outside-In), with a relevant resource to universities. This is consistent with studies carried out by: Chesbrough and Crowther (2006), Bianchi *et al* (2010), Cheng and Huizigh (2010); Chiaroni *et al.* (2010).

Later, we've seen that with the implementation of this new vision, companies have a higher percentage of Outbound and Coupled dimensions. In this way and itemizing each one of the companies, we've noticed the presence of Outbound activities in the following companies: PT Inovação and BIT; and the presence of Coupled activities in the next companies: EDP Inovação, Mota-Engil and Viarco. Companies that have an Outbound dimension are consistent with the study carried out by Gassmann and Enkel (2005), which shows that in high-tech companies, this is the dimension that prevails. For the remaining three companies, it was considered the study prepared by Gassmann and Enkel (2005), where he introduced a new dimension of OI, the Coupled dimension, a combination of the two previous dimensions.

However, unlike the study done by Gassmann and Enkel (2005), Viarco is considered a low-tech company that presents us with a higher use of Coupled activities, i.e., the presence of both Inbound and Outbound activities. This is due to the creation of *ateliers* and networks that promote the flow of knowledge between the company and the outside world. As already mentioned, these *ateliers* allow the exploration of new ideas that may be useful both to the company and to foreign entities.

This project explored the decision made by companies for a paradigm shift and how has this same shift improved their probability to become a more successful enterprise. This research project contributes to the scientific literature in the field, in order to corroborate how many stages there are in the process of implementation of the OI concept and its application into the Portuguese companies. Thus, this study emphasizes the need for significant investments in R&D, the creation of influence networks and the existing flows of knowledge and technologies between companies. As far as practical implications are concerned, it provides conclusions regarding to the organization and development of the OI introduction process and how each of the steps can be improved, so that it is completed successfully.

Therefore, in table 9, it is possible to scrutinize the existing steps in the introduction process of the OI concept and its associated specifications.

Table 9 – Conclusions in each phase of the process of implementation OI on Portuguese enterprises

	Diagnosis	Unfreezing	Moving	Institucionalising	Re-evaluation
Open Innovation	<ul style="list-style-type: none"> • There was not a defining moment • Opening to the concept due to lack of internal capacity self-sufficient • Evolution of the sector that led to the adherence to the concept • Gradual and iterative process 	<ul style="list-style-type: none"> • Need for internal change of mentalities • Transition to a horizontal company type and with a new culture of collaboration; • Constant contacts with universities and national and international entities • Separation of the functions of each network element • Monitoring of external knowledge 	<ul style="list-style-type: none"> • Enlargement of the network to companies, European research projects, clients, forums • Collaboration of people in an outsourcing basis • Placement of challenges directly to the intended entity • Interest from various entities for the learning process of introducing the concept of OI • Encouragement on research to universities • Creation of incentives to creativity in the form of awards • Creation of ateliers inside the company only for the exploration of ideas and materials 	<ul style="list-style-type: none"> • Development of virtual platform, forums and website • Creation of mixed teams • Existence of active patents and licensing 	<ul style="list-style-type: none"> • Support in the creation of Startups; • Long-term protocols with Universities and companies • Possibility to develop new initiatives for collaboration to other entities • Social innovation initiatives with the involvement of the entire community

Source: the author

As our theoretical model predicts, there are five stages in the changing process from CI to OI (Diagnosis, Unfreezing, Moving, Institutionalizing and Reevaluation). In a first stage, a dynamic and supportable administration, as well as an organized and modern structure could act as a facilitator. The Unfreezing stage is related to internal change, so the aversion to uncertainty and technologies by employees makes this step more difficult. A strong leadership and a clear communication to demonstrate all the advantages can be a very useful tool. In the Moving stage, companies enlarged their network, including other firms and universities. Different objectives from different partners can create some constraints, so the use of incentives through awards could be used to motivate the employees. Then, the Institutionalising stage is the adoption of the new paradigm, based on new procedures, like the creation of forums for discussion and knowledge exchange. The last phase, Reevaluation, carries out the possibility to develop new collaboration initiatives for other entities and to support the establishment of Startups, as well as others projects not directly linked to the company.

For all companies in the study, it was possible to verify through the semi-structure interviews that the introduction of the concept was an important milestone for the companies and which continues to offer benefits, so that, according to Venceslau Parreira (from EDP Inovação), it still has "an enormous growth potential".

This study is an exploratory one and has obviously some limitations. First, it is based on only five companies, so that any generalizations of the results and impacts need to be cautiously measured. Another limitation might be the methodology used in the project, so that in other context it might be necessary the use of different methodologies: quantitative and qualitative. Analyzing the implementation process it is possible to verify that this is a process that still has a long way to go, since we cannot identify with a certain degree of reliable the existing tasks in the later stages of the implementation process of OI. However, we hope that the details provided in this project become an important starting point for future research into the journey of Open Innovation concept. Even so, much more research is required in this field, in particular, we need to be aware of the important influence of networks in the development of this concept, as well as future studies are necessary to continue monitoring this process through qualitative and quantitative approaches.

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