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The Adoption of Open Innovation Within the Health Sector: Empirical Evidence of Portugal

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Dissertation presented as partial requirement for obtaining the Master's degree in Information Management

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by

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Dissertation presented as partial requirement for obtaining the Master's degree in Information Management, with a specialization in Information Systems and Technologies Management

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ABSTRACT

Open innovation is now one of the most popular approaches in innovation management. This innovation model recognizes that not all good ideas can arise within the organization itself and, likewise, not all good ideas generated within it can be commercialized internally with success. Open innovation thus promotes collaboration with external partners throughout the innovation process. However, despite the growing interest of research in open innovation, little attention has been given to understanding this paradigm in the health sector. Therefore, this investigation intends to contribute to the literature, exploring the adoption of open innovation in organizations operating in the Portuguese health sector with their professionals. In order to meet the objectives of this study, a quantitative methodology was adopted through the elaboration of an online questionnaire to professionals of health organizations. The results obtained show that health organizations are already engaged in open innovation. Consequently, it was possible to identify the main processes (outside-in and coupled) and their practices (external networking, strategic alliances and customer involvement), as well as the external partners (consultants, commercial labs or private R&D institutes, customers, and universities or other higher education institutions) and motives (to acquire complementary knowledge) for these organizations to engage in open innovation.

KEYWORDS

Open innovation; Health sector; Portugal; Processes and practices; External partners; Motives

RESUMO

A inovação aberta é agora uma das abordagens mais populares na gestão da inovação. Este modelo de inovação reconhece que nem todas as boas ideias podem surgir dentro da própria organização e, da mesma forma, nem todas as boas ideias geradas dentro desta podem ser comercializadas internamente com sucesso. A inovação aberta promove, assim, a colaboração com parceiros externos ao longo do processo de inovação. No entanto, apesar do crescente interesse da investigação em inovação aberta, pouca atenção tem sido dada à compreensão deste paradigma no setor da saúde. Portanto, a presente investigação pretende contribuir para a literatura, explorando a adoção da inovação aberta nas organizações que operam no setor de saúde português junto dos seus profissionais. De forma a dar resposta aos objetivos deste estudo, foi adotada uma metodologia quantitativa através da elaboração de um questionário *online* aos profissionais das organizações de saúde. Os resultados obtidos mostram que as organizações de saúde já estão envolvidas em inovação aberta. Consequentemente, foi possível identificar os principais processos (*outside-in* e *coupled*) e respetivas práticas (redes externas, alianças estratégicas e envolvimento dos clientes), bem como os parceiros externos (consultores, laboratórios comerciais ou institutos privados de P&D, clientes, e universidades ou outras instituições de ensino superior) e motivos (adquirir conhecimentos complementares) para estas organizações se envolverem em inovação aberta.

KEYWORDS

Inovação aberta; Setor de saúde; Portugal; Processos e práticas; Parceiros externos; Motivos

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1. INTRODUCTION

The rise in patients expectations, the availability of new treatments, the increase demand for professional knowledge and the growing economic constraints constantly challenge the ability of the health sector to match the increasing gap between what is feasible, suitable, safe and cost-effective and what happens in practice when health care is provided (Edenius, Keller, & Lindblad, 2010). To bridge this gap, health organizations need to engage in a continual renewal to transform the whole sector in order to deliver better outcomes for patients, better professional development and better system performance. Moreover, in the light of rising health care costs, combined with an ageing population, the increase of chronic diseases, universal access to health care for a growing number of people, and the continuous technological advancement, the ability to generate and absorb innovations has become even more crucial to ensuring the sustainability of the health sector (C. Bianchi, Bianco, Ardanche, & Schenck, 2017; Länsisalmi, Kivimäki, Aalto, & Ruoranen, 2006; Proksch, Busch-Casler, Haberstroh, & Pinkwart, 2019; Wass & Vimarlund, 2016). Therefore, this sector must face the challenge of continuously organizing and managing innovation (Edenius et al., 2010).

According to Bessant, Küenne, & Möslin (2012), the health sector has been suffering from the same problem faced by all kinds of organizations: despite the extensive commitment and investment in developing and commercializing innovations, “not all the smart people work for you” (Chesbrough, 2003a). Organizations have traditionally trusted solely on their internal resources and competences in the pursuit of innovation (Wass & Vimarlund, 2016). That is, they have operated in the light of a closed innovation model, which stresses that innovations are developed and controlled by the organization itself in order to be successful (Chesbrough, 2003a). However, in today’s context characterized by increasing dynamic and complex economic markets, organizations are no longer capable to innovate on their own (Bigliardi & Galati, 2018; van de Vrande, Vanhaverbeke, & Gassmann, 2010). Therefore, organizations must look for a new and open mode of innovation that enables collaboration with external partners during the creation and commercialization of innovations. In this way, the open innovation model has been proposed as a new paradigm for innovation management (van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009). Coined by Chesbrough (2003a), it suggests that organizations can and should use internal as well as external ideas and paths to market in order to achieve and sustain innovation.

Despite the growing interest of research in open innovation (Bogers et al., 2017), there is currently a scarcity of contributions that analyze how and to what extent organizations operating in a given sector implement open innovation (M. Bianchi, Cavaliere, Chiaroni, Frattini, & Chiesa, 2011). Due to this gap presented in the literature, the application of open innovation in the health sector has also been little

investigated (Wass & Vimarlund, 2016). Thus, the present dissertation intends to contribute to the literature, exploring the adoption of open innovation in organizations belonging to the Portuguese health sector with their professionals. To this, the following research question is defined: “Are health sector organizations in Portugal engage in open innovation?”.

Given the generality of the question, specific objectives are also established: understand the level of knowledge concerning the concept of open innovation in health organizations; determine the open innovation processes and practices applied by health organizations (how), and consequently the external innovation partners used by them (with whom); and identify the motives for the use of open innovation (why).

In response to these objectives, this paper is structured as follows: chapter 2 contains the literature review on innovation, closed innovation, open innovation and the contextualization of open innovation in the health sector; chapter 3 addresses the methodology; chapter 4 presents the results; chapter 5 discusses the findings as well as the theoretical and practical implications, study limitations and future research; and finally, chapter 6 presents the conclusion.

2. LITERATURE REVIEW

2.1. INNOVATION

Innovation is not a new subject. This concept was first introduced a long time ago by innovation theorist, Joseph Schumpeter, who did his best to propagate the view that innovation is the main source of economic growth and therefore worthy of study (Fagerberg, Martin, & Andersen, 2013). The definition of innovation, developed by Schumpeter (1934) in his book "The Theory of Economic Development", has become a key reference for contemporary innovation studies: "new combinations", covering the introduction of a new good or even the introduction of new features into an existing good that customers are not familiar with; the establishment of a new production method; the opening of a new market; the access to a new source of supply of raw materials or half-manufactured goods; or the realization of a new organization of an industry. Based on the work developed by Schumpeter, the OECD Committee (Organization for Economic Co-operation and Development) defined innovation as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD & Eurostat, 2005, p.46). These innovations may emerge from new scientific discoveries, public research or even a combination of existing technologies and their application in new contexts (Urbancová, 2013).

Today, innovation is seen as the main currency in modern economies (Neto, Filipe, & Caleiro, 2019), that can arise in any sector of the economy, including the health sector (OECD & Eurostat, 2005). This is because innovation is "the main driver for companies to prosper, grow and sustain a high profitability" (Elmqvist, Fredberg, & Ollila, 2009, p.326) and to achieve a competitive advantage over their competitors (Conto, Júnior, & Vaccaro, 2016).

2.2. A CHANGE IN INNOVATION MANAGEMENT: FROM CLOSED TO OPEN INNOVATION

In a global and increasingly competitive world, where change is the only constant, innovation management becomes crucial for any organization (Amponsah & Adams, 2017; Elmqvist et al., 2009). "Companies are increasingly rethinking the fundamental ways in which they generate ideas and bring them to market" (Chesbrough, 2003b, p.35).

Until a few years ago, most organizations believed that for innovation to be successful there had to be control – "Companies must generate their own ideas and then develop them, build them, market them, distribute them, service them, finance them, and support them on their own." (Chesbrough, 2003a, p.XX). That is, the innovation process should be developed as an internal process of the

organization, where only its internal resources were used exclusively. Organizations should be self-reliant since it is unreliable to depend on the quality, availability and capability of others' ideas: "If you want something done right, you've got to do it yourself" (Chesbrough, 2003a, p.XX).

These ideologies gave rise to the classic model of innovation, designated by economist Henry Chesbrough of "closed innovation", where the organization's innovations are created and modeled within organizational boundaries. The designation of "closed model", is thus due to the unidirectional flow of ideas during the innovation process: "can only enter in one way, at the beginning, and can only exit in one way, by going into the market" (Chesbrough, Vanhaverbeke, & West, 2006, p.2). Figure 2.1 illustrates this flow of ideas representative of this model. The solid lines represent the barriers that protect the organization from the external environment; and the relationship between research and development is strongly coupled and internally focused. Ideas arise at the beginning of the research phase through the organization's science and technology base and in the course of this process some are interrupted and left aside; while other ideas are selected and transferred to the development phase. Then a subset of these are launched in the market by the organization.

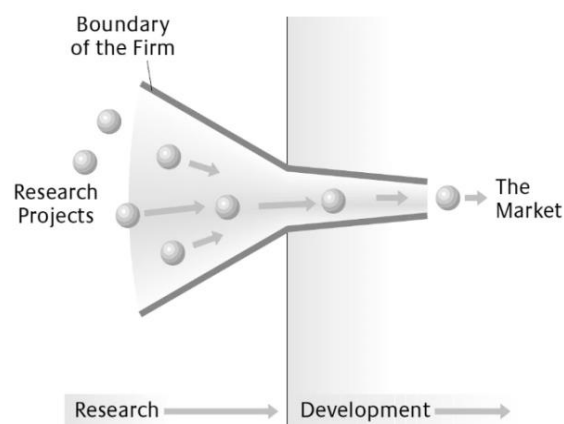


Figure 2.1 - Closed innovation model (Chesbrough, 2003b)

The closed innovation model was then evidenced as the "right way" to develop and commercialize innovations and internal R&D was seen as a powerful strategic asset and a barrier to entry for competitors (Chesbrough, 2003b). Organizations reinforced their investments in internal R&D and in hiring highly skilled individuals. Through these investments, they started to find more and better ideas, allowing them to reach the market first. In turn, this led to organizations earning most of the profits, which they protected through strict control of their intellectual property (IP) to avoid competitors from exploiting it for their own benefit. Later, these profits were reinvested again in more internal R&D in order to search for more innovations. This created a circle of virtuous innovation, resulting in numerous technological advances throughout the twentieth century.

However, since the 1990s, in most large organizations the logic behind the closed innovation strategy has begun to crumble. Chesbrough identified a range of factors, that combined erode the boundaries within which innovation activities occur - "When these erosion factors have impacted an industry, the assumptions and logic that once made Closed Innovation an effective approach no longer applied." (Chesbrough, 2003a, p.XXIII). One of the factors pointed out has to do with the growing availability and mobility of highly experienced and skilled people, enhancing the flows of knowledge among the most diverse organizations. An associated factor is the increasing amount of college and post-college training that individuals have acquired, also contributing to streamline these knowledge flows. Another factor identified is the growing presence of private venture capital (VC), dedicated to the establishment and financing of new companies that commercialize external research. As a result, better conditions have been created for the development of ideas outside the large established organizations. The aptitude of organizations to profit through their own knowledge silos has also been put to the test by ever faster time to market of products and services, making the useful life of a technology shorter. Lastly, organizations are challenged as their customers and suppliers have become more knowledgeable.

In addition to these erosion factors, other authors also highlighted the massification of information and communications technologies (ICTs), allowing to leverage increasingly distributed sources of knowledge (Chesbrough & Bogers, 2014); as well as the rising costs of industrial research and development and the scarcity of resources (Gassmann & Enkel, 2004) as reasons that have been challenging the underpinnings of the closed innovation model.

In this way, managing innovation in a centralized and internally oriented way is now becoming obsolete - "In today's landscape of abundant knowledge, companies can no longer afford to rely entirely on their own ideas to advance their business, nor can they restrict their innovations to a single path to market." (van de Vrande et al., 2010, p.222).

2.3. OPEN INNOVATION

To survive, organizations have begun to feel the need to open their innovation process, as innovating alone is becoming unbearable. In this way, Chesbrough catalyzed a move towards an open innovation model that embraced a new organizational mindset, recognizing that "not all the smart people work for you" (Chesbrough, 2003a), and therefore organizations must use "a wide range of external actors and sources to help them achieve and sustain innovation" (Laursen & Salter, 2006, p.131). This new model, called "open innovation" is defined as:

“a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Open Innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model.” (Chesbrough, 2003a, p.XXIV).

This definition has been the most referenced in the literature, emphasizing that valuable ideas can emerge and be commercialized from inside or outside organizational boundaries (Dahlander & Gann, 2010). External ideas and paths to the market are as important as internal ideas and paths to the market. Therefore, the “open innovation paradigm treats research and development as an open system” (Chesbrough et al., 2006, p.1), as depicted in Figure 2.2. The organization’s boundaries become porous (represented by dashed lines), enabling the flow of ideas to occur in all directions and promoting collaboration with external partners throughout the innovation process (Podmetina, Kutvonen, Albats, & Dąbrowska, 2016). This model is defined as “open” since there are multiple ways for ideas to flow into the process as well as to flow out into the market (Chesbrough et al., 2006; Elmquist et al., 2009). Ideas can come from inside or outside the organization's own labs and can arise at any stage of the R&D process (either in the research or development phase). Likewise, ideas can find countless possible routes to enter the market and at any stage of the R&D process.

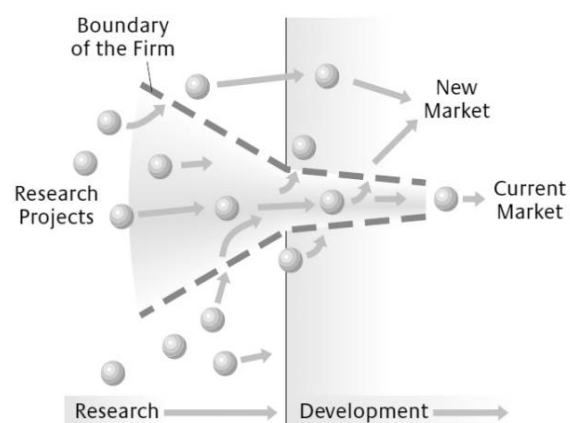


Figure 2.2 - Open innovation model (Chesbrough, 2003b)

For Chesbrough et al. (2006), the “open innovation paradigm can be understood as the antithesis of the traditional vertical integration model where internal R&D activities lead to internally developed products that are then distributed by the firm.” (p.1). In order to distinguish the open innovation model from the closed one, he defined six contrasting principles (Table 2.1) that reflect the key ideas of each model, evidencing the change of mentality in the way of generating, developing and disseminating new ideas and technologies (Chesbrough, 2003a, 2003b).

Closed innovation	Open innovation
The smart people in our field work for us.	Not all the smart people work for us. We must find and tap into the knowledge and expertise of bright individuals outside our company.
To profit from R&D, we must discover, develop, and ship it ourselves.	External R&D can create significant value. Internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to market first.	We do not have to originate the research in order to profit from it.
If we are the first to commercialize an innovation, we will win.	Building a better business model is more vital than getting to market first.
If we create the most and best ideas in the industry, we will win.	If we make the best use of internal and external ideas, we will win.
We should control our intellectual property (IP), so that our competitors do not profit from our ideas.	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model.

Table 2.1 - Principles of closed innovation and open innovation (Chesbrough, 2003a; 2003b)

However, some scholars argue that this contrast between open innovation and closed innovation is nothing more than an illusory dichotomy (Dahlander & Gann, 2010; Marques, 2014; Trott & Hartmann, 2009). Although this dichotomy conveys the idea that the adoption of one model automatically excludes the other, the truth is that these two models may be verifiable realities at different times in the life of an organization, or even in the various phases of the innovation process in a given period. In this way, Dahlander & Gann (2010) claim that open innovation is a continuum, covering several degrees of openness that organizations can embrace in order to reach their innovative goals. According to Marques (2014), the diffusion of this dichotomy emerges only as a useful and stimulating psychological tactic to bring open innovation to organizations.

Open innovation, even though it is a new concept, for some authors is just “old wine in new bottles” as it reflects little more than the repackaging and representation of concepts and discoveries presented in recent years in the innovation literature (Trott & Hartmann, 2009). Dahlander and Gann (2010) highlighted important previously well-established theories on which the open innovation model is based, such as those presented by: Teece (1986); von Hippel (1988); Cohen & Levinthal (1990); March (1991); Lerner & Tirole (2002); among others. However, although open innovation relies on numerous and important existing innovation theories, for Chesbrough et al. (2006), it ends up offering several different perspectives and interpretations, sufficient to consider open innovation as a new paradigm for understanding innovation (Table 2.2).

Points of differentiation for open innovation

1. Equal importance given to external knowledge, in comparison to internal knowledge.
2. The centrality of the business model in converting R&D into commercial value.
3. Type I and Type II measurement errors (in relation to the business model) in evaluating R&D projects.
4. The purposive outbound flows of knowledge and technology.
5. The abundant underlying knowledge landscape.
6. The proactive and nuanced role of IP management.
7. The rise of innovation intermediaries.
8. New metrics for assessing innovation capability and performance.

Table 2.2 - Points of differentiation for open innovation compared to previous theories of innovation
(Chesbrough et al., 2006)

Since the open innovation model was first introduced, there have been conceptual improvements and clarifications that attempt to reconcile the different studies that emerge both from Henry Chesbrough and other authors. As a result, there are currently numerous definitions of open innovation (Table 2.3). In general, these definitions somehow incorporate notions such as cooperation with the environment, knowledge flows, permeability of the organization's boundaries, deliberate adoption of practices and factors that affect the success of open innovation (Gianiodis, Ellis, & Secchi, 2010; West, Salter, Vanhaverbeke, & Chesbrough, 2014).

Reference	The concept of open innovation
(Chesbrough, 2003a, p.XXIV)	"a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Open Innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model."
(Gassmann & Enkel, 2004, p.2)	"Open innovation means that the company needs to open up its solid boundaries to let valuable knowledge flow in from the outside in order to create opportunities for cooperative innovation processes with partners, customers and/or suppliers. It also includes the exploitation of ideas and IP in order to bring them to market faster than competitors can"
(Chesbrough et al., 2006, p.1)	"use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively."
(West & Gallagher, 2006, p.320)	"We define open innovation as systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources, and broadly exploiting those opportunities through multiple channels."
(Dittrich & Duysters, 2007, p.512)	"The system is referred to as open because the boundaries of the product development funnel are permeable. Some ideas from innovation projects are initiated by other parties before entering the internal funnel; other projects leave the funnel and are further developed by other parties."
(Perkmann & Walsh, 2007, p.259)	"This means that innovation can be regarded as resulting from distributed inter-organizational networks, rather than from single firms."
(Lichtenthaler, 2008, p.148)	"An open innovation approach refers to systematically relying on a firm's dynamic capabilities of internally and externally carrying out the major technology management tasks, i.e., technology acquisition and technology exploitation, along the innovation process."
(Terwiesch & Xu, 2008, p.1529)	"There exist a rapidly growing number of innovation processes that rely on the outside world to create opportunities and then select the best from among these alternatives for further development. This approach is often referred to as open innovation."

(Gianiodis et al., 2010, p.41)	“We define open-innovation strategy as a business model that is designed to purposefully allow and facilitate knowledge and technology transfers across organizational boundaries.”
(Chesbrough & Bogers, 2014, p.17)	“we define open innovation as a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model.”
(Tidd, 2014, p.1)	“The open innovation model emphasizes that firms should acquire valuable resources from external firms and share internal resources for new product/service development (...)”
(Podmetina et al., 2016, p.166)	“Open innovation process is a process enabling in- and outflow of ideas, knowledge, innovation technologies through “porous” borders of organisation on all stages of innovation process.”
(Amponsah & Adams, 2017, p.2)	“The concept is used to describe innovation processes in which firms interact extensively with their environment, leading to a significant amount of external knowledge (EK) exploration (KET) and exploitation (KEL).”
(Tynnhamar, 2017)	“Open Innovation is: Knowledge sharing, across organisational borders, as part of a business model with a variety of many partners working together during the whole, or part of, development process.”
(Öberg & Alexander, 2019, p.212)	“This suggests a partially linear process where new products and services are conceived and then developed as part of a collaboration activity, taking ideas and initiatives from within the organisation and outside of the organisation to create an amalgam of ideas, capabilities, competences and knowledge from the contributing partners.”

Table 2.3 - Open Innovation definitions

2.3.1. Open innovation processes and practices

An important feature of the open innovation model is the perception that the locus of knowledge does not necessarily need to be the locus of innovation (Gassmann & Enkel, 2004). In this way, considering the inflows and outflows of knowledge, three core processes can be distinguished in the open innovation model (Enkel, Gassmann, & Chesbrough, 2009; Gassmann & Enkel, 2004), as shown in Figure 2.3: outside-in, inside-out and coupled. Outside-in and inside-out processes can also be labeled inbound and outbound, respectively (Bogers, Chesbrough, & Moedas, 2018).

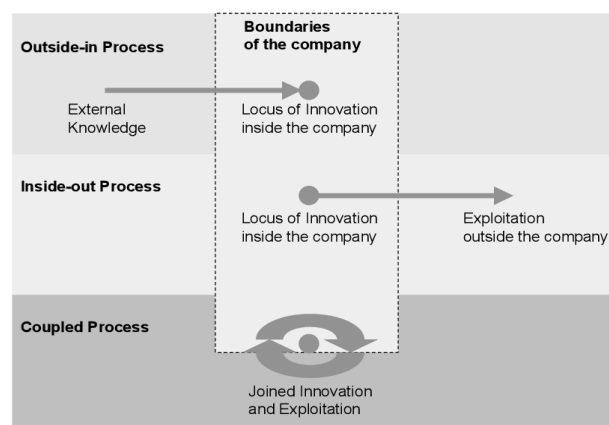


Figure 2.3 - Decoupling the locus of knowledge and innovation (Gassmann & Enkel, 2004)

The outside-in process occurs when external knowledge is brought within the organization's boundaries to be integrated into its innovation process (Enkel et al., 2009; Gassmann & Enkel, 2004). It consists in leveraging the discoveries that arise in the external environment, by opening up to and establishing relationships with external partners, in order to improve the organization's innovativeness (Chiaroni, Chiesa, & Frattini, 2011). In other words, this process corresponds to technology exploration (van de Vrande et al., 2009). Within the outside-in process, there is a growing awareness of the importance of innovation networks, new forms of customer integration (such as crowdsourcing, mass customization and customer community integration) and the use of innovation intermediaries (such as InnoCentive) (Enkel et al., 2009). Existing academic research and business practice have paid greater attention to the outside-in open innovation process (Bogers et al., 2018; Chesbrough & Bogers, 2014; Chesbrough & Crowther, 2006; Enkel et al., 2009; Podmetina et al., 2016; West et al., 2014).

In turn, in the inside-out process, the organization's internal knowledge or R&D results are taken beyond its organizational boundaries to be integrated by others (Enkel et al., 2009; Gassmann & Enkel, 2004). It suggests that organizations may seek external partners who have more suitable business models for the commercialization of a given technology (Chiaroni et al., 2011), allowing them to bring their ideas to market faster than they could through internal development (Enkel et al., 2009). Furthermore, this enables organizations to participate in other market segments, not just restricting themselves to markets that directly serve. Therefore, the inside-out process relates to technology exploitation and can help increase an organization's revenue immensely (Gassmann & Enkel, 2004; van de Vrande et al., 2009). Within this process, there is an increasing awareness of corporate venturing activities, new business models (such as new ventures and spin-offs) and the commercialization of ideas in new markets (Enkel et al., 2009).

Finally, the coupled process arises when the organization simultaneously uses the outside-in process (to acquire external knowledge) and the inside-out process (to transfer internal ideas to market) in order to jointly develop and commercialize innovations (Enkel et al., 2009; Gassmann & Enkel, 2004). This process thus includes co-creations with complementary external partners through, for example, alliances and joint ventures, during which giving and receiving are crucial to success.

Thus, according to Gassmann & Enkel (2004), these three processes represent an open innovation strategy whose importance differs from organization to organization (Figure 2.4). Not all organizations choose the same process of open innovation or integrate the three processes to the same degree. Each organization may adopt a primary process, integrating some characteristics of the others.

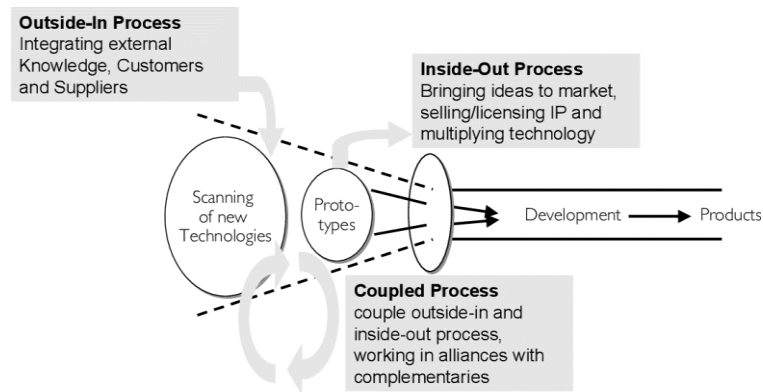


Figure 2.4 - Open innovation processes (Gassmann & Enkel, 2004)

For each of these open innovation processes different types of practices can be identified (Huizingh, 2011). Table 2.4 thus presents a list of possible practices, resulting from the analysis of existing research that addresses open innovation processes (Bigliardi & Galati, 2016, 2018; Chesbrough & Brunswicker, 2013; Podmetina et al., 2016; van de Vrande et al., 2009).

Practices	Definitions
Outside-in process	
Customer involvement	Directly involvement of customers in the generation, evaluation, and testing of novel ideas.
External networking	Draw on or collaborate with external network partners to support the innovation process (e.g., with universities and research centres).
Inward IP licensing	Purchase or use of external IP of other organizations (e.g., patents, copyrights, trademarks).
Internet exploration	Use internet to search for innovative ideas or technologies.
Know-how acquisition	Buy R&D work from other organizations.
Innovation intermediaries	Contracting services from intermediary organizations specialized in open innovation to act as a mediator between an organization with a problem and a network of organizations and individuals with possible solutions.
Inside-out process	
Outward IP licensing	Sell of internal IP to other organizations (e.g., patents, copyrights, trademarks).
Knowledge exploitation	Make unused organizational innovations available to third parties for free.
Knowledge provision	Participate in innovation projects of other organizations.
Spin-offs	Investment in new ventures founded by organization's employees outside organizational boundaries.
Coupled process	
Alliances	Voluntary cooperation agreements between organizations, involving exchange and sharing of knowledge or co-development of innovations.
Joint ventures	Agreement between organizations, in which the resources of each are gathered to create a separate legal entity for executing a certain innovation project.

Table 2.4 - Open innovation practices (Bigliardi & Galati, 2016, 2018; Chesbrough & Brunswicker, 2013; Podmetina et al., 2016; van de Vrande et al., 2009)

Therefore, to implement open innovation practices organizations may establish relationships, both weak and strong, as formal or informal, with different external partners (Bigliardi & Galati, 2018). The external partners for open innovation proposed by the OECD (2008) include suppliers, customers, competitors or other organizations in the same sector, consultants, commercial laboratories or private R&D institutes, universities or other higher education institutions, and government or public research institutes.

2.3.2. Motives for open innovation

According to Chesbrough (2003a), open innovation has begun to be implemented as an organizational adaptation necessary to respond to the previously mentioned changes in the environment. However, throughout the open innovation literature, several scholars have made a further exploration of the motives associated with the adoption of this innovation model (e.g., Bigliardi & Galati, 2018; Chesbrough & Crowther, 2006; Huizingh, 2011; van de Vrande et al., 2009).

Through the study developed by van de Vrande et al. (2009), it is possible to cluster the motives for open innovation into seven distinct categories, as presented in Table 2.5. It is important to note that the categories of motives related to the involvement of employees who are not directly involved in the organization's R&D were not considered, since this practice refers to the internal use of the organization's own knowledge, not involving any kind of collaboration with external entities. van de Vrande et al. (2009) found that the most important motives are market-related ones. This means, that open innovation is considered above all as a way to keep up with market developments and meet customer demand, resulting in higher growth, better financial results or increased market share. Other important motives are related to the effectiveness of the innovation process and the acquisition of knowledge, while motives related to control, focus, costs and capacity are less common. An important finding of this study is that the different open innovation practices seem to have the same underlying motives. Thus, a distinction of these motives according to practices is not necessary.

Category	Examples
Control	Greater control over activities; better organization of complex processes
Focus	Fit with core competencies; clear focus of organization activities
Innovation Process	Enhanced development of innovations; integration of new technologies; develop innovations faster and more effective
Knowledge	Gain knowledge; bring expertise to the organization
Costs	Cost management, profitability, efficiency
Capacity	Cannot do it alone; counterbalance lack of capacity

Market	Keep up with current market developments; meet customers demand; increase growth and/or market share
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Table 2.5 - Motives to adopt open innovation (van de Vrande et al., 2009)

2.4. OPEN INNOVATION AND THE HEALTH SECTOR

Innovation emerges as a critical factor in the development and survival of organizations in the health sector, gaining importance not only in the literature but also among practitioners (Edenius et al., 2010; Lämsäsalmi et al., 2006; Proksch et al., 2019; Wass & Vimarlund, 2016). However, there are increasing challenges and obstacles to innovation in health care. The introduction of innovations is a particularly difficult and complex process due to rising costs, long product development cycles, excessive regulations, structural inertia of health organizations, the peculiar nature of health care markets, the lack of financial sources to implement innovations and the risks associated with them (Fleuren, Wiefferink, & Paulussen, 2004; Lämsäsalmi et al., 2006; Suojanen, Heemskerk, & Serafini, 2011). Therefore, although the need for innovation in health organizations is recognized, the generation of innovations and their adoption is often complicated (Lämsäsalmi et al., 2006).

It is argued that, in order to address such contextual challenges to innovations in health care and related to the growing need for innovation, all health organizations need to undergo a paradigm shift in innovation management (Bessant et al., 2012). Referred to as open innovation, this model, by opening up the traditionally closed innovation process, will enable to achieve and sustain a greater degree of innovation. For example, in a study applied to life science companies, Belussi, Sammarra, & Sedita (2010) concluded that the open innovation model better explains the innovative performance of these companies than the closed model, where only internal R&D is used. That finding is in line with Dias & Escoval (2012) who identified the external collaboration as being the main driver of innovation in hospitals. Therefore, there is “mounting evidence that open innovation fosters improved effectiveness, affordability and innovation in the health sector.” (Dal Molin, 2011, p.22).

Currently, there is a scarcity of contributions that analyze how and to what extent organizations operating in a given sector implement open innovation (M. Bianchi et al., 2011). And the health sector is no exception (Wass & Vimarlund, 2016). So far, in the health context, only M. Bianchi et al. (2011) tried to explain how bio-pharmaceutical companies use different organizational modes (such as, licensing agreements, non-equity alliances, purchase and supply of technical and scientific services) to relate to different external partners (such as, large pharmaceutical companies, product biotech firms, platform biotech firms and universities) in order to acquire or exploit knowledge and technologies.

Despite the application of open innovation to the health sector is still little explored (Wass & Vimarlund, 2016), it has been advocated that a key direction in which innovation in health care must be opened is to harness the knowledge of consumers (Bessant et al., 2012; Boote, Telford, & Cooper, 2002; Bullinger, Rass, Adamczyk, Moeslein, & Sohn, 2012; Bullinger, Rass, & Moeslein, 2012; Priyadarshini, Quinlan, & Doyle, 2017). A consumer, who is also called a patient, user or client, is simply a recipient or a potential recipient of health care (Boote et al., 2002). While in the past the integration of users in health care research and development has been hampered by significant costs, current technological advances, especially the availability of interactive web-based technologies and the trend towards social networking, now allow the integration of users in innovation activities to be profitable and viable (Bullinger, Rass, Adamczyk, et al., 2012; Priyadarshini et al., 2017). Thus, many organizations have started to integrate them intensively into their innovation processes (Bullinger, Rass, & Moeslein, 2012). This is the case of hospitals, where although traditionally there is a high level of cooperation with educational institutions, the growing focus on the user has been highlighted (Dias & Escoval, 2012). The results of this study showed that there are few hospitals that do not have any kind of cooperation with hospital services' users. As far as life science companies are concerned, the study shows that customers already emerge as the most frequently used external partner (Belussi et al., 2010).

Although open innovation is a good practice to employ in normal times, it becomes even more vital in times of crisis. The current crisis caused by the Covid-19 pandemic has shown just that. Based on the recent study of Chesbrough (2020) it can be seen that many of the developments that have occurred in response to the pandemic, have had one thing in common: openness. Since the beginning of the pandemic, large amounts of information about the virus, its spread, and human responses to various public health measures have been made available. There has also been a rapid mobilization of scientists, pharmaceutical companies and government officials to drive a series of scientific initiatives in order to discover an effective response to the virus. According to Chesbrough (2020), there has also been crowdsourcing for disease management therapies, more ways to design and manufacture masks, hand sanitizers and ventilators. In order to overcome the shortage of ventilators, Medtronic, for example, opened its ventilator design for anyone to make, waiving their IP rights over the design. There are also reports of individual physicians modifying the ventilators to serve several patients simultaneously. Finally, in relation to the scarcity of personal protective equipment, users have been playing an important role in producing their own hand sanitizers and making their own masks, based on the information available on the internet. Therefore, openness has helped to respond to the pandemic, by creating partnerships to produce and acquire extremely needed capabilities, treatments and supplies (Burrill, Betts, Kroll, Wheeler, & Sogar, 2020).

3. METHODOLOGY

3.1. TYPE OF STUDY

According to Perry (2011), the study can be classified by three intersecting continua: Exploratory - Confirmatory, Basic - Applied, and Qualitative - Quantitative.

On the first dimension, Exploratory-Confirmatory, the present study can be classified as exploratory, since the main objective is to explore a phenomenon, in this case the application of open innovation in health organizations, prior the development of any hypothesis. Because it is a subject scarcely portrayed in literature, there is therefore a place for its exploration. On the second dimension, Basic-Applied, this is an applied study, because it aims to generate knowledge and a better understanding of this open innovation phenomenon in the context of health care and consequently produce valuable and significant findings for health organizations. Finally, on the third dimension, Qualitative-Quantitative, it is a quantitative study, through the elaboration of a questionnaire to professionals of health organizations, seeking to gather information about the application of open innovation model in these organizations.

3.2. POPULATION AND SAMPLING

The population corresponds to the set of elements that share a certain characteristic, on which information is intended to be acquired. In the case of this study, it corresponds to the professionals of health organizations operating in the Portuguese health sector. Health organizations are those that “deliver health care goods and services as their primary activity, as well as those for which health care provision is only one among a number of activities.” (OECD, Eurostat, & World Health Organization, 2017, p.122).

Table 3.1 shows the main categories and subcategories of domestic health care providers included in this definition. The first six categories, HP.1 to HP.6, are considered primary providers, whose main activity is to provide health care goods and services. In turn, the categories HP.7 and HP.8 (except subcategory HP.8.9) correspond to secondary providers, as they provide health care goods and services in addition to their core activities, which may or may not be related to health. Finally, the subcategory HP.8.9 refers to any industry that carries out health-related activities, but without providing health goods and services directly to patients, either as primary or secondary provider. That is, industries engaged in the supply of medical equipment, health research and development or in the education and training of health professionals.

Code	Description
HP.1	Hospitals
HP.1.1	General Hospitals
HP.1.2	Mental health hospitals
HP.1.3	Specialized hospitals (other than mental health hospitals)
HP.2	Residential long-term care facilities
HP.2.1	Long-term nursing care facilities
HP.2.2	Mental health and substance abuse facilities
HP.2.9	Other residential long-term care facilities
HP.3	Providers of ambulatory health care
HP.3.1	Medical practices
HP.3.1.1	Offices of general medical practitioners
HP.3.1.2	Offices of mental medical specialists
HP.3.1.3	Offices of medical specialists (other than mental medical specialists)
HP.3.2	Dental practice
HP.3.3	Other health care practitioners
HP.3.4	Ambulatory health care centres
HP.3.4.1	Family planning centres
HP.3.4.2	Ambulatory mental health and substance abuse centres
HP.3.4.3	Free-standing ambulatory surgery centres
HP.3.4.4	Dialysis care centres
HP.3.4.9	All other ambulatory centres
HP.3.5	Providers of home health care services
HP.4	Providers of ancillary services
HP.4.1	Providers of patient transportation and emergency rescue
HP.4.2	Medical and diagnostic laboratories
HP.4.9	Other providers of ancillary services
HP.5	Retailers and other providers of medical goods
HP.5.1	Pharmacies
HP.5.2	Retail sellers and other suppliers of durable medical goods and medical appliances
HP.5.9	All other miscellaneous sellers and other suppliers of pharmaceuticals and medical goods
HP.6	Providers of preventive care
HP.7	Providers of health care system administration and financing
HP.7.1	Government health administration agencies
HP.7.2	Social health insurance agencies
HP.7.3	Private health insurance administration agencies
HP.7.9	Other administration agencies
HP.8	Rest of economy
HP.8.1	Households as providers of home health care
HP.8.2	All other industries as secondary providers of health care
HP.8.9	Other industries n.e.c.

Table 3.1 - Classification of health care providers (OECD et al., 2017)

Since the aim of the study is to explore the application of open innovation in health organizations with their professionals, it is important that they have knowledge or are involved in the innovation processes of their organizations. Thus, the sample of this study is composed of professionals from health organizations who meet at least one of the following criteria: professionals with management profiles (top, middle and lower-level management) and professionals involved in R&D and innovation activities of the organization. The purpose of this sample is to select cases that are rich in information in order to achieve the objectives of the investigation.

3.3. DATA COLLECTION

As a method of data collection, within the survey strategy, it was decided to use an online questionnaire, which was developed through the survey tool SurveyMonkey. Before its application, the questionnaire was submitted to a pre-test.

The dissemination of the questionnaire was made by direct invitation to professionals of health organizations, which met at least one of the sample criteria, through email and message on the social network LinkedIn. In this social network, a publication was made with the disclosure of the questionnaire in a closed group of users, belonging to the association Health Cluster Portugal, directed at themes of innovation and development in health. Finally, emails were also sent to health organizations so that they could share the questionnaire with their professionals who held management positions and/or were involved in R&D and innovation activities of the organization.

The questionnaire was accompanied by an introduction explaining the scope of the work, the objectives and the reason for the study as well as the concept of open innovation. The cooperation of the professionals covered by the study was requested for the realization of the questionnaire, also informing them about the average time of completion. In this introduction, the anonymity of the participants and their organizations, as well as the use of the data obtained exclusively for scientific purposes was also guaranteed.

The data collection was conducted over a two-month period, from April to June 2020, and 242 complete and validated responses were obtained at the end.

3.4. QUESTIONNAIRE

According to Hill & Hill (1998), the questionnaire should be clearly written and be accessible to the understanding of all respondents. Since this study is inserted in the organizations of the health sector in Portugal, the questionnaire was conducted in Portuguese in order to facilitate its understanding.

Taking into account the objectives defined for the study, the questionnaire (Annex I) was organized in four different sections. The questions and the respective response options were underpinned by the theoretical framework presented in the previous chapter.

The first section of the questionnaire intends to investigate innovation in health organizations in a very general way. In this sense, the first question aims to gather the opinions of respondents about the importance that innovation has for their organization, on a scale of 1="Not at all important" to 7="Extremely important". In this questionnaire, it was decided to use seven-point Likert scales

(Symonds, 1924). Following, in the second question a scale of agreement was defined, in which 1="Strongly disagree" and 7="Strongly agree", to ascertain whether the health organization is innovative from the respondent's point of view. Finally, in order to identify what kind of innovations are introduced in these organizations, a multiple answer question was asked with the various types of innovation identified in the literature. The "Don't know/ No answer" option was included, as this question requires specific knowledge of the respondent on the subject (Hill & Hill, 1998).

The second section, focusing on the research theme of this dissertation, aims to collect evidence of open innovation in health organizations. In this way, the first question is devoted to understanding how the organization's innovations have been generated and brought to the market, that is, whether through the exclusive use of the organization's internal resources and/or through collaboration with external innovation partners. This single answer question acts as a filter question, where individuals who choose the "Open innovation" or "Both strategies" option move on to the next question, while the rest who choose "Closed innovation" or "Don't know/ No answer" option move on to the last two questions in this section.

The next three questions explore how (processes and practices), with whom (external innovation partners) and why (motives) health organizations adopt open innovation. Thus, the second question in this section seeks to investigate which are the main open innovation processes and practices used by health organizations, and the third question which are the main external innovation partners that these organizations use in their innovation activities. Both questions are multiple answer, where are listed as answer options the possible practices and external innovation partners based on the literature review, as well as a "Don't know/ No answer" option. The fourth question aims to obtain information on the main motivations of health organizations to use open innovation. In this question, respondents were asked for their opinion on the importance of each motive identified in the literature, on a scale of 1="Not at all important" to 7="Extremely important".

The last two questions in this section are addressed to all respondents, regardless of whether they belong to health organizations that apply open innovation or not. One question intends to understand whether respondents consider open innovation to be an asset to their organization, on a scale of 1="Strongly agree" to 7="Strongly disagree". The other question aims to investigate which external innovation partners are most important in the respondents' opinion, on a scale of 1= "Not at all important" to 7="Extremely important".

The third section of the questionnaire was designed with the aim of collecting basic information about the organization, through single answer questions about the type of health organization, whether it is a private, public or social organization, and its geographical location.

Finally, in the last section, in order to characterize the respondent, an open answer question was asked about the function performed in the organization and two single answer questions regarding gender and age. The last question, dedicated to understanding the respondent's level of knowledge about open innovation, was placed on a scale of 1="Terrible" to 7="Excellent".

3.5. DATA PROCESSING

At the end of the survey period, 356 responses were obtained from health organization professionals, with only 242 being considered for data treatment and analysis: 38 were invalidated because the respondent did not occupy any of the organizational functions specified in the sample criteria; and the remaining 76 for being incomplete.

The validated responses were transferred from the SurveyMonkey platform to an Excel spreadsheet, in order to facilitate their analysis. The data processing was based on descriptive statistical analysis with determination of frequencies, response rates and weighted averages. For the presentation of the results, tables and graphs (bar and circular) were used.

4. RESULTS

4.1. SAMPLE CHARACTERIZATION

Regarding the distribution of the sample by the type of health organization (Table 4.1), it was found that of the 242 individuals who comprise the sample, 36.78% belong to the HP.1 Hospitals category, 21.49% to the HP.3 Providers of ambulatory health care, 18.18% to the HP.5 Retailers and other providers of medical goods and 14.46% to the HP.8 Rest of economy. Of the remaining individuals, 3.31% belong to the categories HP.4 Providers of ancillary services and to HP.7 Providers of health care system administration and financing, and 2.48% to the HP.2 Residential long-term care facilities category. This sample is not composed of individuals belonging to the HP.6 Providers of preventive care category. It was also observed that 63.64% of these respondents are from private sector organizations (N=154), 33.47% from the public sector (N=81) and 2.89% from the social sector (N=7).

Health organizations	Frequency	Percentage
HP.1 Hospitals	89	36.78%
HP.2 Residential long-term care facilities	6	2.48%
HP.3 Providers of ambulatory health care	52	21.49%
HP.4 Providers of ancillary services	8	3.31%
HP.5 Retailers and other providers of medical goods	44	18.18%
HP.6 Providers of preventive care	0	0.00%
HP.7 Providers of health care system administration and financing	8	3.31%
HP.8 Rest of economy	35	14.46%
Total	242	100%

Table 4.1 - Distribution of the sample by type of health organization

As for geographical location of organizations (Figure 4.1), the majority of respondents, 52.07%, belongs to health organizations located in the Lisbon Metropolitan Area (N=126).

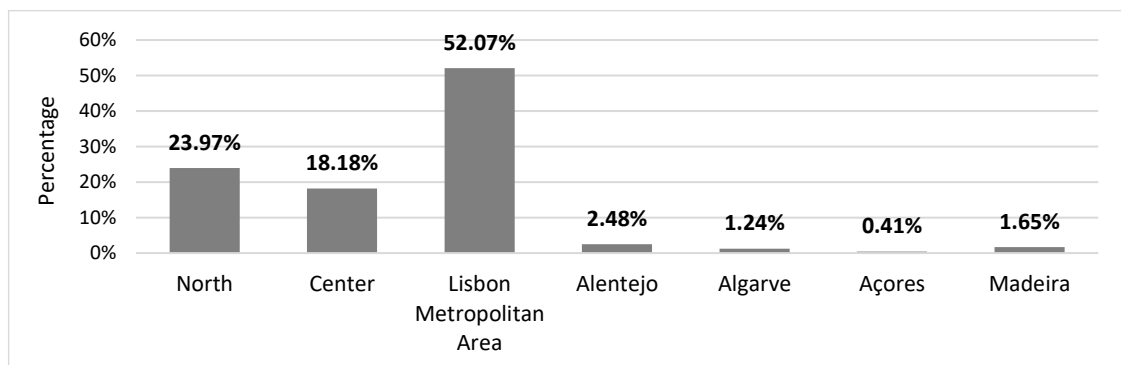


Figure 4.1 - Distribution of the sample by geographical location in Portugal of the health organization

Concerning the distribution of individuals by the organizational function they occupy in their health organization (Figure 4.2), 96.69% perform managerial functions (N=234). The remaining 3.31% do not hold management positions but are involved in the organization’s R&D and innovation activities (N=8).

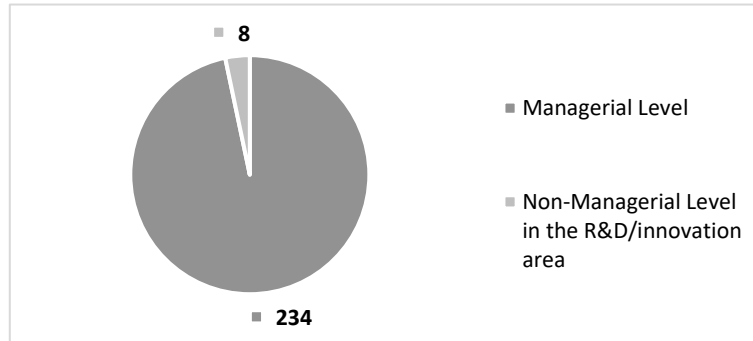


Figure 4.2 - Distribution of the sample by functions held in the organization

Table 4.2 presents the distribution of the sample by gender and by age groups: 56.20% of individuals are male and 43.80% female; and most of the individuals, are in the age group of 41 to 50 years (35.12%), followed by those aged between 31 and 40 years (27.69%) and between 51 and 60 years (22.73%).

Features		Frequency	Percentage
Gender	Female	106	43.80%
	Male	136	56.20%
Age	22-30	17	7.02%
	31-40	67	27.69%
	41-50	85	35.12%
	51-60	55	22.73%
	≥ 61	18	7.44%
Total		242	100%

Table 4.2 - Distribution of the sample by gender and age group

Finally, in order to characterize the sample as to the level of knowledge about the concept of open innovation, a scale from 1 (Terrible) to 7 (Excellent) was defined. In the record of responses (Figure 4.3), 28.51% of responses were obtained for level 5 of knowledge (N=69), 25.21% for level 4 (N=61), 22.31% for level 6 (N=54) and 2.07% for level 7 (N=5). The remaining responses correspond to low levels of knowledge: 11.16% of responses for level 3 (N=27), 6.20% for level 2 (N=15) and 4.55% for level 1 (N=11).

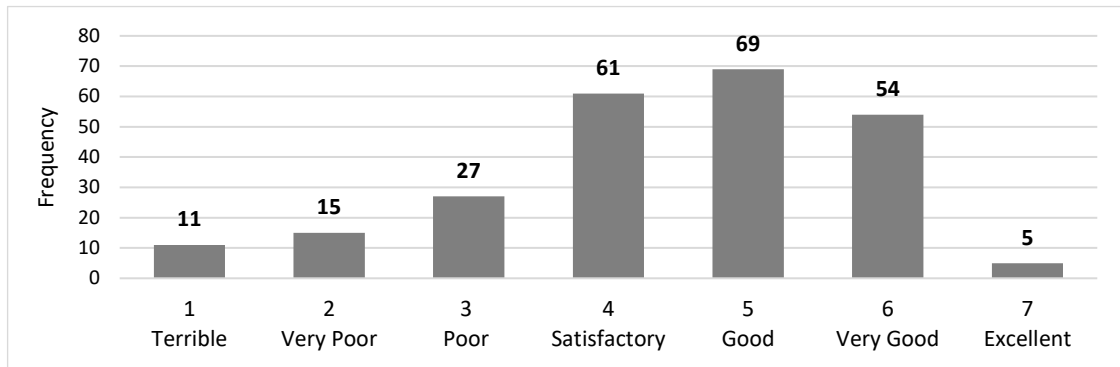


Figure 4.3 - Distribution of the sample by knowledge level in relation to open innovation

Of the 242 respondents, it is observed that there is a reasonable level of knowledge about the concept (weighted average = 4.42). By comparing the level of knowledge in each type of health organization (Table 4.3), it is verified that individuals from organizations belonging to the HP.2 Residential long-term care facilities category are those who have the best knowledge about open innovation (weighted average = 5.17).

	Weighted average							
	Total N=242	HP.1 N=89	HP.2 N=6	HP.3 N=52	HP.4 N=8	HP.5 N=44	HP.7 N=8	HP.8 N=35
Level of knowledge about the open innovation concept.	4.42	4.38	5.17	4.25	4.50	4.39	4.88	4.57

Legend

Likert Scale: 1 - Terrible; 2 - Very poor; 3 - Poor; 4 - Satisfactory; 5 - Good; 6 - Very good; 7 - Excellent.

Health organizations: HP.1 - Hospitals; HP.2 - Residential long-term care facilities; HP.3 - Providers of ambulatory health care; HP.4 - Providers of ancillary services; HP.5 - Retailers and other providers of medical goods; HP.7 - Providers of health care system administration and financing; HP.8 - Rest of economy

Table 4.3 - Average level of knowledge about open innovation according to the type of health organization

4.2. INNOVATION IN HEALTH ORGANIZATIONS

The first section of the questionnaire had as its main objective to investigate innovation in health organizations in a very general way.

The section thus began with a question that measured the importance attributed to innovation in the health organization, on a scale from 1 (Not at all important) to 7 (Extremely important). Figure 4.4 shows that the vast majority of the sample, 67.36%, considers innovation extremely important for their organization (N=163).

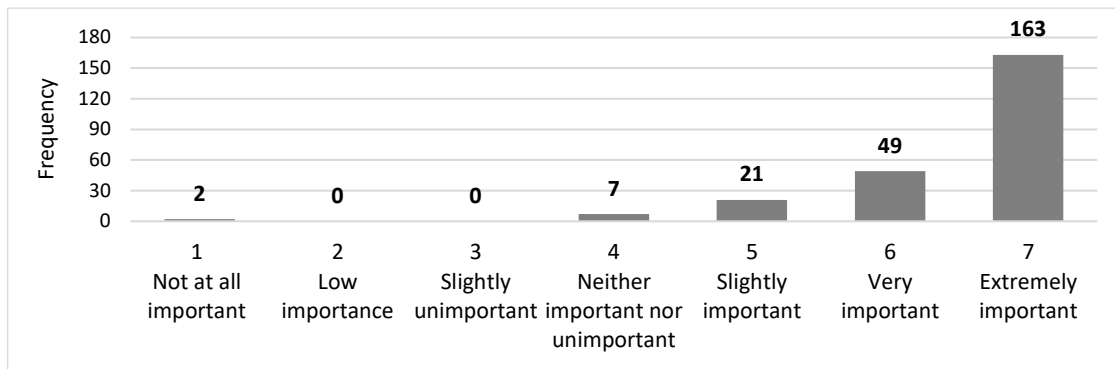


Figure 4.4 - Importance attributed to innovation in health organizations

Analyzing the importance given to innovation in each type of health organization (Table 4.4), it is possible to verify that regardless of the type of organization, respondents consider innovation to be very important.

	Weighted average							
	Total N=242	HP.1 N=89	HP.2 N=6	HP.3 N=52	HP.4 N=8	HP.5 N=44	HP.7 N=8	HP.8 N=35
Importance of innovation for the health organization.	6.49	6.45	6.67	6.35	6.25	6.73	6.50	6.51

Legend

Likert Scale: 1 - Not at all important; 2 - Low importance; 3 - Slightly unimportant; 4 - Neither important nor unimportant; 5 - Slightly important; 6 - Very important; 7 - Extremely important.

Health organizations: HP.1 - Hospitals; HP.2 - Residential long-term care facilities; HP.3 - Providers of ambulatory health care; HP.4 - Providers of ancillary services; HP.5 - Retailers and other providers of medical goods; HP.7 - Providers of health care system administration and financing; HP.8 - Rest of economy.

Table 4.4 - Average level of importance attributed to innovation according to the type of health organization

Next, when asked if they consider their organization innovative (Figure 4.5), on a scale of 1 (Strongly disagree) to 7 (Strongly agree), it is found that 28.10% of respondents slightly agree (N=68), 25.21% agree (N=61), 19.42% show neither agree nor disagree (N=47) and 11.57% strongly agree (N=28). The remaining 15.70% of the sample state that they somehow do not agree (levels 1, 2 and 3) with the fact that their organization is innovative (N=38).

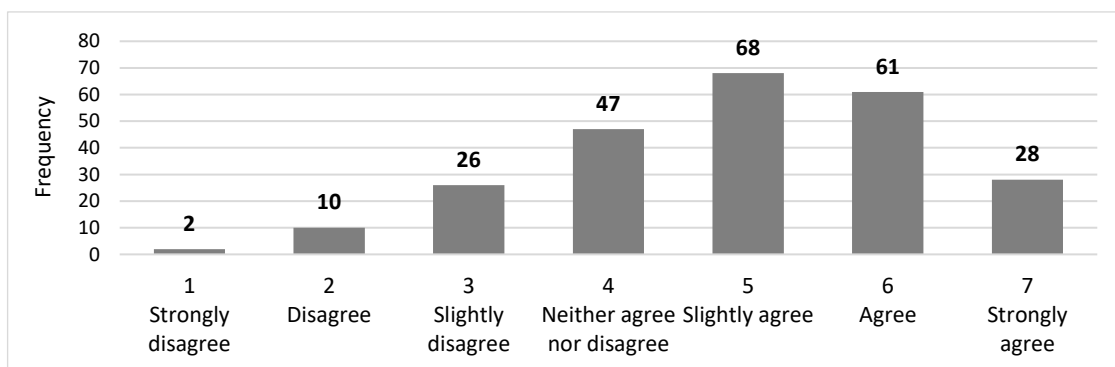


Figure 4.5 - Health organizations are considered innovative

At the level of each type of health organization, it can be verified that individuals belonging to the HP.2 Residential long-term care facilities category have a greater expressiveness of agreement (weighted average = 6.33) regarding their organization being innovative, in comparison with other individuals (Table 4.5). On the other hand, the individuals in the HP.1 Hospitals category are the least expressive (weighted average = 4.53).

	Weighted average							
	Total N=242	HP.1 N=89	HP.2 N=6	HP.3 N=52	HP.4 N=8	HP.5 N=44	HP.7 N=8	HP.8 N=35
Considers the health organization innovative.	4.92	4.53	6.33	4.83	5.38	5.14	5.00	5.40

Legend
Likert Scale: 1 - Strongly disagree; 2 - Disagree; 3 - Slightly disagree; 4 - Neither agree nor disagree; 5 - Slightly agree; 6 - Agree; 7 - Strongly agree.
Health organizations: HP.1 - Hospitals; HP.2 - Residential long-term care facilities; HP.3 - Providers of ambulatory health care; HP.4 - Providers of ancillary services; HP.5 - Retailers and other providers of medical goods; HP.7 - Providers of health care system administration and financing; HP.8 - Rest of economy.

Table 4.5 - Average level of agreement regarding the organization being innovative according to the type of health organization

Regarding the types of innovation introduced by these health organizations (Figure 4.6), 75.62% of the sample says they are product innovations (N=183), 70.66% process innovations (N=171), 50.41% organizational innovations (N=122) and 34.71% marketing innovations (N=84). It was found that 2.07% of individuals responded “Don’t know/No answer” (N=5).

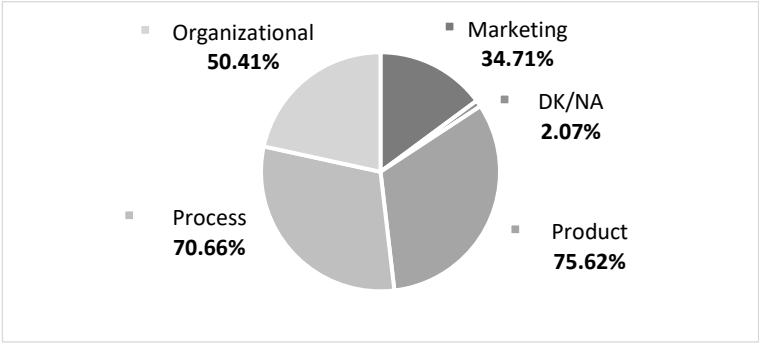


Figure 4.6 - Types of innovation introduced in health organizations

Distributing the types of innovation according to the type of health organization (Table 4.6), it can be seen that, regardless of the type of organization, product innovations as well as process innovations are the most common.

	Frequency							
	Total N=242	HP.1 N=89	HP.2 N=6	HP.3 N=52	HP.4 N=8	HP.5 N=44	HP.7 N=8	HP.8 N=35
Product innovation	183	61	5	41	6	36	6	28
Process innovation	171	63	4	35	6	30	8	25
Marketing innovation	84	21	3	21	2	22	3	12
Organizational innovation	122	42	4	24	3	22	6	21
DK/NA	5	4	0	1	0	0	0	0

Legend

Health organizations: HP.1 - Hospitals; HP.2 - Residential long-term care facilities; HP.3 - Providers of ambulatory health care; HP.4 - Providers of ancillary services; HP.5 - Retailers and other providers of medical goods; HP.7 - Providers of health care system administration and financing; HP.8 - Rest of economy.

Table 4.6 - Types of innovation according to the type of health organization

4.3. ADOPTION OF OPEN INNOVATION IN HEALTH ORGANIZATIONS

The second section of the questionnaire aimed to collect evidence of open innovation in health organizations.

Thus, the first question in this section was dedicated to gathering information on how the innovations of these organizations have emerged and been commercialized (Figure 4.7). Of the 242 individuals, 34.30% state that it has been through the exclusive use of the organization's internal resources, that is, through a closed innovation strategy (N=83). On the other hand, 10.74% claim that it has been through collaboration with external innovation partners, that is, through an open innovation strategy (N=26). Of the remaining responses obtained, 50.83% of respondents say that the health organization adopts both strategies (N=123). In this question it was found that 4.13% of individuals responded "Don't know/No answer" (N=10).

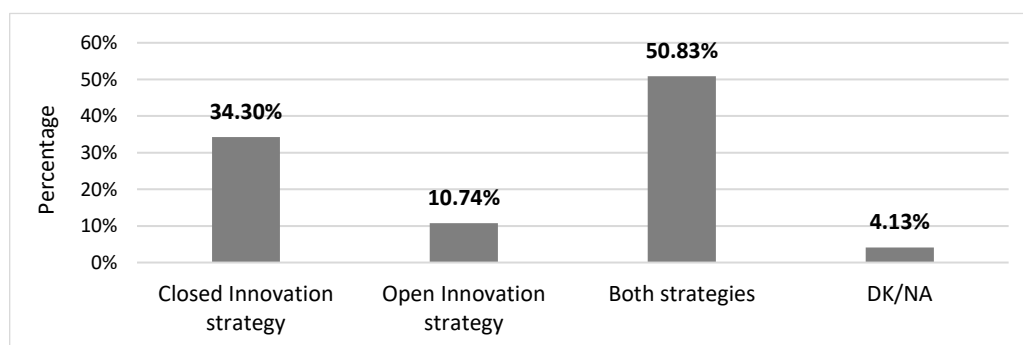


Figure 4.7 - How innovations in health organizations arise

Continuing the analysis through the distribution of responses according to the type of health organization (Table 4.7), it is possible to conclude that, in general open innovation is already adopted in any type of health organization.

	Frequency							
	Total N=242	HP.1 N=89	HP.2 N=6	HP.3 N=52	HP.4 N=8	HP.5 N=44	HP.7 N=8	HP.8 N=35
Closed innovation strategy	83	32	2	23	2	14	2	8
Open innovation strategy	26	14	0	3	0	4	1	4
Both strategies	123	38	4	23	6	25	5	22
DK/NA	10	5	0	3	0	1	0	1

Legend

Health organizations: HP.1 - Hospitals; HP.2 - Residential long-term care facilities; HP.3 - Providers of ambulatory health care; HP.4 - Providers of ancillary services; HP.5 - Retailers and other providers of medical goods; HP.7 - Providers of health care system administration and financing; HP.8 - Rest of economy.

Table 4.7 - How innovations arise according to the type of health organization

Linking this question with the one that investigates whether the organization is innovative from the respondent’s point of view, it is possible to infer the following results: of the 38 respondents who do not consider their organization innovative (who respond with levels 1, 2 and 3), 22 belong to organizations where open innovation is not adopted; on the other hand, of the 157 respondents who consider their organization to be innovative (who respond with levels 5, 6 and 7), 112 belong to organizations that apply open innovation. This demonstrates that there is a positive relationship between the application of open innovation and the innovative character of the health organization.

The next three questions were directed at the 149 individuals who responded that their health organization adopts open innovation (who answered in the previous question “Open innovation strategy” or “Both strategies”), in order to investigate how (processes and practices), with whom (external innovation partners) and why (motives) organizations innovate openly.

Regarding the open innovation practices most commonly applied by respondents' health organizations (Figure 4.8), it was found that two individuals responded, “Don't know/No answer”. Analyzing the remaining answers, it is possible to conclude that the most used practices are external networking (69.13%), strategic alliances (57.05%) and customer involvement (49.66%). On the side of the less used are practices such as inward intellectual property licensing (12.75%), spin-offs (10.74%) and outward intellectual property licensing (6.04%).

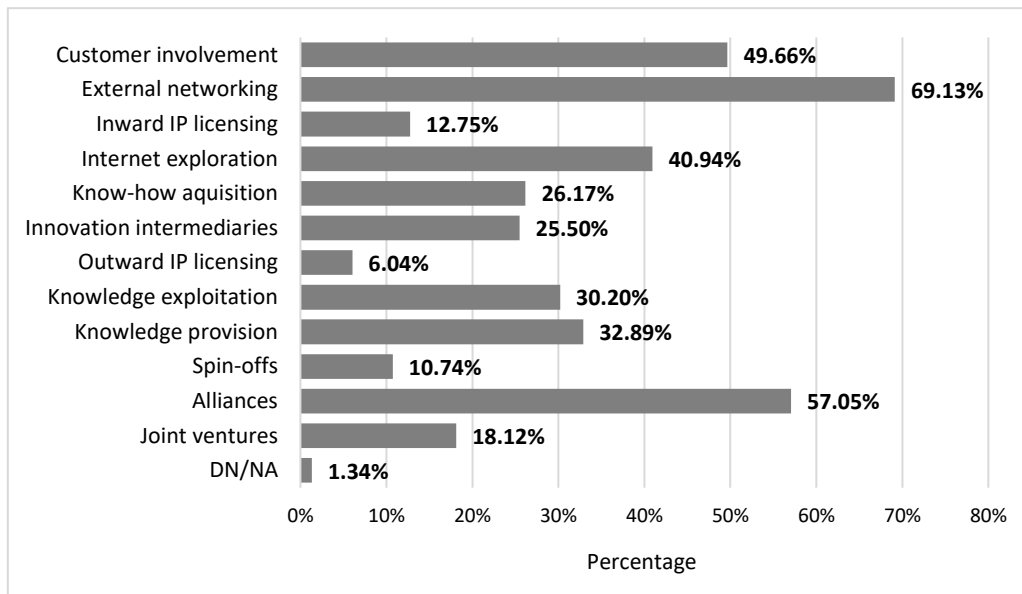


Figure 4.8 - Open innovation practices adopted by health organizations

Comparing the practices used in each type of health organization (Table 4.8), it can be seen that, both in HP.1 Hospitals and in organizations of the HP.3 Providers of ambulatory health care, HP.5 Retailers and other providers of medical goods and HP.8 Rest of economy categories, the external networking is the most widely used open innovation practice. As for organizations of the HP.2 Residential long-term care facilities and HP.4 Providers of ancillary services categories, the most commonly practice is the use of strategic alliances. Finally, in the HP.7 Providers of health care system administration and financing category, practices such as customer involvement, external networking, strategic alliances, and joint ventures are the most adopted.

	Frequency							
	Total N=149	HP.1 N=52	HP.2 N=4	HP.3 N=26	HP.4 N=6	HP.5 N=29	HP.7 N=6	HP.8 N=26
Customer involvement	74	18	2	15	2	17	4	16
External networking	103	31	2	16	4	22	4	24
Inward IP licensing	19	6	0	1	0	8	1	3
Internet exploration	61	20	2	13	1	14	2	9
Know-how acquisition	39	13	1	4	0	11	3	7
Innovation intermediaries	38	13	1	2	1	11	2	8
Outward IP licensing	9	3	1	0	0	2	0	3
Knowledge exploitation	45	16	2	6	3	8	2	8
Knowledge provision	49	22	1	9	1	4	3	9
Spin-offs	16	4	0	0	1	6	1	4
Alliances	85	24	3	12	5	20	4	17
Joint ventures	27	7	1	4	0	3	4	8

DK/NA	2	1	0	1	0	0	0	0
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Legend

Health organizations: HP.1 - Hospitals; HP.2 - Residential long-term care facilities; HP.3 - Providers of ambulatory health care; HP.4 - Providers of ancillary services; HP.5 - Retailers and other providers of medical goods; HP.7 - Providers of health care system administration and financing; HP.8 - Rest of economy.

Table 4.8 - Open innovation practices adopted according to the type of health organization

As regards the external partners employed in the innovation processes of health organizations (Figure 4.9), it is concluded that consultants, commercial labs or private R&D institutes (50.34%), customers (49.66%), as well as universities or other higher education institutions (47.65%) are the most requested partners. With less expressiveness are external innovation partners such as competitors or organizations in the same sector (33.56%) and government or public research institutes (22.82%). In this question it was found that two individuals responded “Don’t know/No answer”.

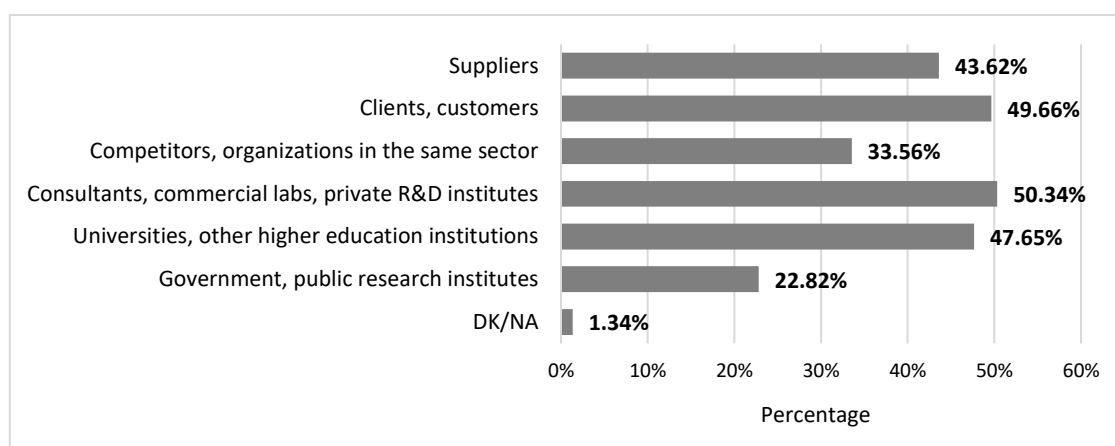


Figure 4.9 - External innovation partners used by health organizations

The distribution of external innovation partners according to the type of health organization (Table 4.9), makes it possible to verify that also the partners used vary depending on the type of organization. Specifically, in the case of HP.1 Hospitals, the external partners most commonly used are universities or other higher education institutions. In turn, in the organizations of the HP.2 Residential long-term care facilities category are customers, competitors or other organizations in the same sector as well as consultants, commercial labs or private R&D institutes. In relation to the HP.3 Providers of ambulatory health care category, organizations primarily use suppliers and customers in their innovation processes. As for organizations in the HP.4 Providers of ancillary services, HP.5 Retailers and other providers of medical goods and HP.7 Providers of health care system administration and financing categories, consultants, commercial labs or private R&D institutes emerge as the most frequent external innovation partners. Finally, organizations in the HP.8 Rest of economy category mainly use customers.

	Frequency							
	Total N=149	HP.1 N=52	HP.2 N=4	HP.3 N=26	HP.4 N=6	HP.5 N=29	HP.7 N=6	HP.8 N=26
Suppliers	65	26	1	15	2	14	2	5
Clients, customers	74	18	2	15	2	17	4	16
Competitors, organizations in the same sector	50	9	2	10	1	15	1	12
Consultants, commercial labs, private R&D institutes	75	22	2	9	4	18	5	15
Universities, other higher education institutions	71	33	1	6	2	10	4	15
Government, public research institutes	34	15	0	2	2	7	1	7
DK/NA	2	2	0	0	0	0	0	0

Legend
Health organizations: HP.1 - Hospitals; HP.2 - Residential long-term care facilities; HP.3 - Providers of ambulatory health care; HP.4 - Providers of ancillary services; HP.5 - Retailers and other providers of medical goods; HP.7 - Providers of health care system administration and financing; HP.8 - Rest of economy.

Table 4.9 - External innovation partners used according to the type of health organization

In relation to the motives of health organizations for open innovation (Table 4.10), it seems that all are moderately important in the respondents' opinion, with the exception of the those related to control (weighted average = 4.68). Nevertheless, it is possible to identify the motives related to the acquisition of knowledge as being the most important ones (weighted average = 5.64).

The distribution of motivations according to the type of health organization (Table 4.10) reveals that the main motives for the adoption of open innovation in organizations belonging to the categories HP.1 Hospitals, HP.3 Providers of ambulatory health care, HP.5 Retailers and other providers of medical goods and HP.8 Rest of economy are related to the acquisition of knowledge. Regarding organizations of the HP.2 Residential long-term care facilities category, the main motives are related to focus and knowledge acquisition. In turn, in organizations of the HP.4 Providers of ancillary services category, the most important motives are related to costs and market. Lastly, in organizations belonging to the HP.7 Providers of health care system administration and financing category, more importance is attached to market-related motives.

	Weighted average							
	Total N=149	HP.1 N=52	HP.2 N=4	HP.3 N=26	HP.4 N=6	HP.5 N=29	HP.7 N=6	HP.8 N=26
Control	4.68	4.71	5.75	4.50	5.00	4.93	4.50	4.31
Focus	5.16	5.00	6.50	4.85	5.17	5.28	5.33	5.42
Innovation process	5.08	4.75	6.00	4.73	5.33	5.52	5.83	5.23
Knowledge	5.64	5.42	6.50	5.27	5.50	5.90	5.67	6.04
Costs	5.06	4.65	5.75	5.04	5.67	5.34	5.00	5.35
Capacity	5.03	5.23	6.25	4.69	5.00	5.21	5.00	4.62
Market	5.38	5.06	6.25	4.96	5.67	5.86	6.33	5.50

Legend

Likert Scale: 1 - Not at all important; 2 - Low importance; 3 - Slightly unimportant; 4 - Neither important nor unimportant; 5 - Moderately important; 6 - Very important; 7 - Extremely important.

Health organizations: HP.1 - Hospitals; HP.2 - Residential long-term care facilities; HP.3 - Providers of ambulatory health care; HP.4 - Providers of ancillary services; HP.5 - Retailers and other providers of medical goods; HP.7 - Providers of health care system administration and financing; HP.8 - Rest of economy.

Table 4.10 - Average level of importance attributed to the motives for open innovation according to the type of health organization

The last two questions in this section were directed to all respondents, regardless of whether they belong to health organizations that apply open innovation or not. The first aimed to gather the respondents' opinion about the added value of open innovation for their health organization, on a scale of 1 (Strongly disagree) to 7 (Strongly agree) (Table 4.11). It is concluded that, in general, all respondents agree that open innovation is an asset (weighted average = 6.22). It is important to note that individuals belonging to organizations where open innovation is not applied, agree that this innovation model can be an advantage for their organization (weighted average = 6.14).

	Weighted average		
	Total N=242	Organizations that adopt open innovation N=149	Organizations that do not adopt open innovation N=83
Considers open innovation an added value for the health organization.	6.22	6.30	6.14

Legend

Likert Scale: 1 - Strongly disagree; 2 - Disagree; 3 - Slightly disagree; 4 - Neither agree nor disagree; 5 - Slightly agree; 6 - Agree; 7 - Strongly agree.

Table 4.11 - Average level of agreement in relation to the added value of open innovation for health organizations

The final question addressed which external innovation partners the respondents consider most important to be incorporated into their organization's innovation processes, on a scale of 1 (Not at all important) to 7 (Extremely important). It can be seen (Figure 4.10), that all external partners presented are considered moderately important, with the exception of competitors or other organizations in the same sector (weighted average = 4.90) and suppliers (weighted average = 4.78). However, universities

or other higher education institutions can be highlighted as the most important external innovation partners for health organizations, according to respondents (weighted average = 5.81).

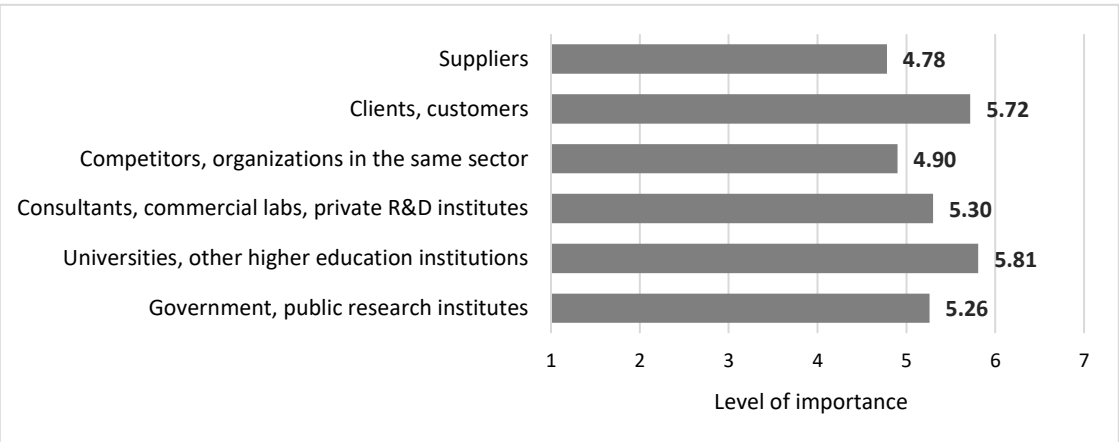


Figure 4.10 - Average level of importance attributed to external innovation partners for health organizations

5. DISCUSSION

The results obtained show that respondents consider innovation to be very important for their health organization (weighted average = 6.49), regardless of the type of organization. In general, attitudes towards innovations in the health sector are positive since innovation is seen as a critical capacity to ensure the sustainability of health organizations (Edenius et al., 2010; Länsisalmi et al., 2006; Proksch et al., 2019; Wass & Vimarlund, 2016). However, it is verified that individuals have a lower expressiveness of agreement as to their health organization being innovative (weighted average = 4.92). This result can be justified by the fact that there are increasing challenges and obstacles to innovation in health care (Fleuren et al., 2004; Länsisalmi et al., 2006; Suojanen et al., 2011), making the generation of innovations and their adoption a difficult and complex case for health organizations. Nevertheless, the innovations introduced by these organizations are mainly product innovations (75.62%), which in this case can be translated, for example, into medical devices and health care related services; as well as process innovations (70.66%) concerning, for example, processes improvements related to the diagnosis and treatment of diseases.

Regarding the way health organizations generate these innovations and bring them to market, 34.30% of respondents state that their organization adopts a closed innovation model, in which innovation is developed and controlled by the organization itself, and 10.74% say that it adopts an open innovation model, where innovation arises through collaboration with external partners. The remaining 50.83% of respondents say that their health organization ends up adopting both innovation models, showing that they are verifiable realities at different times in the life of an organization, or even at various stages of the innovation process (Dahlander & Gann, 2010; Marques, 2014; Trott & Hartmann, 2009). Through these results, it is possible to conclude that health sector organizations in Portugal are engage in open innovation (10.74% + 50.83%), regardless of the type of organization. In fact, despite the few existing studies in the health area, Belussi et al. (2010) and M. Bianchi et al. (2011) had already shown that both life science and bio-pharmaceutical companies adhere to the open innovation model, since they integrate external partners into their innovation activities. Moreover, Dias & Escoval (2012) also revealed the open nature of innovation in hospitals. Along these lines, the results obtained in this study demonstrate that open innovation is already adopted in the various types of organizations operating in the health sector.

The analysis allows to highlight the existence of a positive relationship between the application of open innovation and the innovative character of the health organization: 71.34% of respondents who consider their health organization innovative, belong to an organization where this new innovation model is already adopted. This finding is completely in line with the studies of Belussi et al. (2010) and

Dias & Escoval (2012), who showed, respectively, that the open innovation model better explains the innovative performance of life science companies compared to the closed one, and that external collaboration is the major driver of innovation in hospitals. Thus, it is possible to conclude that open innovation promotes innovation in the health sector (Dal Molin, 2011).

This study also sought to explore the application of open innovation in health organizations, trying to understand how (processes and practices), with whom (external innovation partners) and why (motives) they openly innovate.

With regard to the most widely used open innovation practices, the ones that stand out are external networking (69.13%), strategic alliances (57.05%) and customer involvement (49.66%). The analysis also shows that the type of health organization has an influence on the open innovation practices adopted. In particular, in organizations belonging to the HP.1 Hospitals, HP.3 Providers of ambulatory health care, HP.5 Retailers and other providers of medical goods and HP.8 Rest of economy categories, the external networking is the most commonly used practice. In turn, in organizations of the HP.2 Residential long-term care facilities and HP.4 Providers ancillary services categories is the creation of strategic alliances. Finally, in the HP.7 Providers of health care system administration and financing category, practices such as customer involvement, external networking, strategic alliances, and joint ventures are the most used.

This leads to the conclusion that the practices associated with the outside-in process (especially external networking and customer involvement), as well as those associated with the coupled process (especially strategic alliances) are more intensively adopted by health organizations compared to the practices of the inside-out process, where knowledge provision (32.89%) is the most frequently used practice. To some extent, this turns out to be coherent with existing research on open innovation, which shows that there is a greater predisposition of organizations to implement inbound modes than outbound modes (Bogers et al., 2018; Chesbrough & Bogers, 2014; Chesbrough & Crowther, 2006; Enkel et al., 2009; Podmetina et al., 2016; West et al., 2014). This can be justified by the fact that there is a greater facility in acquiring and using external knowledge than in bringing the organization's internal knowledge to the market (West et al., 2014).

As far as the external innovation partners are concerned, it is concluded that consultants, commercial labs or private R&D institutes (50.34%), customers (49.66%), as well as universities or other higher education institutions (47.65%) are the most used by health organizations. The results also reveal that the external innovation partners most employed by health organizations vary according to the type of organization. Specifically, in organizations of the HP.1 Hospitals category, are universities or other

higher education institutions and in those of the HP.2 Residential long-term care facilities category are customers, competitors or other organizations in the same sector, as well as consultants, commercial labs or private R&D institutes. In turn, the most used external partners in organizations belonging to the HP.3 Providers of ambulatory health care category are suppliers and customers. In relation to organizations of the HP.4 Providers of ancillary services, HP.5 Retailers and other providers of medical goods and HP.7 Providers of health care system administration and financing categories, consultants, commercial labs or private R&D institutes emerge as the most frequent external innovation partners. Finally, organizations in the HP.8 Rest of economy category mainly use customers.

Through the results described above, it is possible to conclude that, in general, health organizations are following the key direction in which innovation in health care should open up, which lies in harnessing the innovation potential of customers (Bessant et al., 2012; Boote et al., 2002; Bullinger, Rass, Adamczyk, et al., 2012; Bullinger, Rass, & Moeslein, 2012; Priyadarshini et al., 2017). That is consistent with the findings of Belussi et al. (2010), who identified customers as the most frequently used external innovation partner used by life science companies. That finding is also in line with Dias & Escoval (2012), who, although they have shown that educational institutions emerge as the most widely used external partner, the vast majority of hospitals also have some kind of cooperation with hospital services' users. Thus, it can be stated that there is an appreciation on the part of health organizations regarding the centrality of customer involvement as a catalyst for change in the provision of health care and contributor to positive health outcomes (Dias & Escoval, 2012).

According to the answers given by the respondents, the most important motives why health organizations choose to engage in open innovation are related to the acquisition of knowledge (weighted average = 5.64). The need to acquire complementary knowledge tends to stretch health organizations towards an open innovation model. However, it can be concluded that the other motives identified in the literature are considered moderately important in the respondents' point of view, with the exception of control-related motives (weighted average = 4.68). It is also noted that the main motivations vary according to the type of health organization. For organizations belonging to the HP.1 Hospitals, HP.3 Providers of ambulatory health care, HP.5 Retailers and other providers of medical goods and HP.8 Rest of economy categories the main motives are related to the acquisition of knowledge. For organizations of the HP.2 Residential long-term care facilities category are related to focus and knowledge acquisition, and for those of the HP.4 Providers of ancillary services category are related to costs and market. Lastly, in organizations belonging to the HP.7 Providers of health care system administration and financing category, greater importance is given to market-related motives.

Finally, it is important to refer that, in general, respondents have a reasonable level of knowledge about open innovation (weighted average = 4.42), proving to be a model already approached throughout the health sector, even if it is not yet adopted in all organizations. Consequently, they agree with the fact that open innovation is an asset for their health organization (weighted average = 6.22), regardless of whether these respondents belong to organizations where this innovation model is applied or not. This demonstrates a general awareness of the importance of openness in innovation processes. In the opinion of the respondents, the most important external partners, or in other words, those that can add more value to the innovation process of their health organization, are universities or other higher education institutions (weighted average = 5.81).

5.1. THEORETICAL AND PRACTICAL IMPLICATIONS

From a theoretical perspective, this paper contributes to the existing literature on open innovation, studying the adoption of this innovation model in a sector where it has been very little investigated to date (M. Bianchi et al., 2011; Wass & Vimarlund, 2016). In this way, it is intended to extend open innovation research to the health sector, exploring how (open innovation processes and practices), with whom (external innovation partners) and why (motives) health organizations engage in this innovation model.

This study shows that organizations operating in the health sector are engaged in open innovation, especially through the adoption of practices such as external networking, strategic alliances and customer involvement, to enter into relationship with different types of external partners, including mainly consultants, commercial labs or private R&D institutes, as well as customers, and universities or other higher education institutions, with the aim of acquiring complementary knowledge. The results obtained thus suggest that health organizations are more able to implement outside-in and coupled open innovation processes than the inside-out process. On the one hand, both existing academic research and business practice have paid greater attention to the outside-in open innovation process, neglecting both inside-out and coupled processes (Bogers et al., 2018; Chesbrough & Bogers, 2014; Chesbrough & Crowther, 2006; Enkel et al., 2009; Podmetina et al., 2016; West et al., 2014). However, the present study contributes to demonstrate that in practice, in addition to the outside-in process, the coupled process is also of great relevance in the health care context, particularly through the establishment of strategic alliances, and, therefore, should be further explored by future researchers.

Furthermore, this paper also reveals that the type of health organization has an influence on the way open innovation is adopted and that there is a positive relationship between the adoption of open

innovation and the innovative character of health organizations. Thus, this exploratory study ends up raising some interesting issues that should be further investigated in the future.

In turn, from a practical perspective, a deeper understanding of the open innovation model could be crucial to helping health organizations take a step forward in openness, especially at a time when this openness is extremely needed to respond to the Covid-19 pandemic (Chesbrough, 2020). In this sense, it is expected that this study will be useful for health organizations to understand the potential of open innovation, as well as the different possibilities of practices, external partners and motives they have to engage in open innovation.

5.2. LIMITATIONS AND FUTURE RESEARCH

There are some limitations that should be recognized in order to be considered in future studies. First, the sample obtained in this study was not as representative as desirable, not only because a large number of responses were not achieved, but also because it was not possible to cover professionals from all types of health organizations. Moreover, given the asymmetry of the sample by type of health organization, it was impossible to get representative conclusions in the results comparing the types of organizations to which the respondents belong. Increasing the sample is one of the points that should be improved in future research in order to achieve greater diversity and representation of the population. Second, the data collection was based only on the application of a questionnaire. If, in addition, a qualitative data collection had been carried out, for example through interviews or focus groups with professionals from health organizations, this would have enabled a better understanding of the application of open innovation. Finally, another limitation identified is that the list of practices, external partners and motives provided may not be complete and may not include all the options that health organizations have to engage in open innovation. Thus, future research should try to explore all the possibilities that may exist for these organizations.

Despite these limitations, this study should encourage both scholars and practitioners to analyze in greater depth open innovation in the health sector, since this paper represents only a first step towards exploring a topic that needs future research. Thus, a first suggestion for future studies is to confirm and deepen the results obtained through the collection of survey data at the organizational level or through administrative data. Another suggestion is to explore the barriers for open innovation in health organizations, that is, what can prevent them from adopting this innovation model.

6. CONCLUSIONS

These days, any organization needs to radically change the way it innovates. Instead of developing and commercializing innovations on their own, organizations should embrace the open innovation model as a new way to innovate, exchanging knowledge, resources, or capabilities with external partners. This paper represents one of the first empirical attempts to investigate the adoption of the open innovation model within the health sector, studying the particular case of the Portuguese health sector. The findings obtained through the application of a questionnaire to professionals of health organizations reveal the openness of innovation in the health sector. Health organizations are engaged in open innovation, especially through the adoption of practices associated with outside-in and coupled processes, such as external networking, strategic alliances and customer involvement, to enter into relationship with different types of external partners, privileging mainly consultants, commercial labs or private R&D institutes, as well as customers, and universities or other higher education institutions, with the aim of acquiring complementary knowledge. Therefore, in this sector there is a greater predisposition to implement outside-in and coupled open innovation processes compared to the inside-out process. This study also shows that through open innovation health organizations can achieve and sustain a greater degree of innovation. In this way, these results provide insights for both theory and practice in the field of open innovation and the health sector.

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8. ANNEXES

I. Questionnaire



ADOÇÃO DA INOVAÇÃO ABERTA NO SETOR DA SAÚDE

Nota introdutória

O presente questionário está integrado no desenvolvimento da dissertação de mestrado, que tem como principal objetivo estudar a adoção do modelo de Inovação Aberta nas organizações do setor da saúde em Portugal.

Nos dias de hoje, a inovação torna-se cada vez mais desafiadora, dispendiosa e arriscada para qualquer indústria. Para superar estes desafios, as organizações devem começar por adotar o modelo de Inovação Aberta, colaborando com parceiros externos (por exemplo, clientes, fornecedores, universidades) ao longo do processo de inovação da organização. A Inovação Aberta defende, assim, que as organizações devem usar ideias internas e externas, como também, formas de chegar ao mercado internas e externas, para sustentar e alcançar a inovação.

O questionário deve ser preenchido por profissionais que ocupem um cargo de gestão e/ou que estejam envolvidos em atividades de P&D e inovação da sua organização. A sua resposta será um importante contributo para esta investigação, uma vez que existem poucos fundamentos teóricos e empíricos sobre a aplicação do modelo de Inovação Aberta no setor da saúde.

O questionário é anónimo e todos os dados recolhidos serão tratados com confidencialidade e utilizados apenas para o propósito deste estudo.

O tempo médio de preenchimento deste questionário é cerca de 6 minutos.

Para qualquer dúvida, não hesite em contactar através do e-mail m20180381@novaims.unl.pt.

Muito obrigada pela atenção dispensada e pela sua colaboração!

Margarida Palma

Prof. Guilherme Victorino

ADOÇÃO DA INOVAÇÃO ABERTA NO SETOR DA SAÚDE

PARTE 1: INOVAÇÃO NA ORGANIZAÇÃO

***1. Como percebe a importância da inovação no sucesso da sua organização?**

Nada importante							Muito importante
1	2	3	4	5	6	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

***2. Considera que a sua organização é inovadora?**

Discordo Fortemente							Concordo Fortemente
1	2	3	4	5	6	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

***3. As inovações desenvolvidas/implementadas pela sua organização são normalmente de que tipo?**

Por favor, selecione **todas** as opções que se aplicam:

- Produto
(Ex: Introdução de um bem ou serviço novo ou significativamente melhorado)
- Processo
(Ex: Introdução de um novo ou significativamente melhorado processo de produção, de diagnóstico ou de tratamento de doença, método de distribuição ou atividade de suporte ao negócio)
- Marketing
(Ex: Introdução de novas técnicas ou meios de comunicação para a promoção de bens ou serviços, alterações na estética ou embalagem de produtos, introdução de novas políticas de preço)
- Organizacional
(Ex: Introdução de novos métodos e práticas de negócios, organização do local de trabalho ou relações externas)
- NS/NR

ADOÇÃO DA INOVAÇÃO ABERTA NO SETOR DA SAÚDE

PARTE 2: ADOÇÃO DO MODELO DE INOVAÇÃO ABERTA

*4. De que forma têm surgido as inovações da sua organização?

Por favor, selecione **apenas** uma das seguintes opções:

- As inovações da organização são desenvolvidas e implementadas dentro dos limites organizacionais através do uso exclusivo de conhecimentos, ideias e recursos internos disponíveis (isto é, através de uma estratégia de Inovação Fechada).
[se escolheu esta opção, poderá saltar diretamente para a pergunta 8]
- As inovações da organização são desenvolvidas e implementadas através da colaboração com parceiros externos, como por exemplo, clientes, fornecedores, universidades, entre outras (isto é, através de uma estratégia de Inovação Aberta).
- Ambas
- NS/NR
[se escolheu esta opção, poderá saltar diretamente para a pergunta 8]

*5. Que práticas de Inovação Aberta têm sido utilizadas pela sua organização?

Por favor, selecione **todas** as opções que se aplicam:

- Envolvimento do Cliente**
Envolvimento dos clientes na geração, avaliação e testes de novas ideias.
- Networking**
Recorrer ou colaborar com parceiros externos para apoiar o processo de inovação (ex.: universidades, fornecedores, centros de investigação).
- Compra de propriedade intelectual externa**
Compra ou uso de propriedade intelectual externa de outras organizações (ex.: patentes).
- Exploração da Internet**
Uso da internet para procurar conhecimentos, ideias e tecnologias inovadoras.
- Aquisição de Know-how**
Compra de trabalho de pesquisa e desenvolvimento (P&D) de outras entidades.
- Intermediários de Inovação**
Contratação de serviços de organizações intermediárias especializadas em inovação aberta para atuar como mediador entre uma organização com um problema e uma rede de organizações e indivíduos com possíveis soluções (ex.: InnoCentive).
- Venda de propriedade intelectual interna**
Venda de propriedade intelectual interna a outras organizações (ex.: patentes).
- Exploração do conhecimento**
Disponibilização gratuita de conhecimentos, ideias ou inovações organizacionais não utilizadas a outras organizações.

- Provisão de conhecimento**
Participação da organização em projetos de inovação de outras organizações.
- Spin-offs**
Investimento em novos empreendimentos fundados por funcionários da organização fora dos limites organizacionais.
- Alianças Estratégicas**
Acordo de cooperação voluntária com outras organizações, envolvendo a troca e partilha de conhecimentos ou o co-desenvolvimento de inovações.
- Joint Ventures**
Acordo com outras organizações, no qual os recursos de cada uma são reunidos para criar uma entidade legal separada, com o intuito de executar um determinado projeto de inovação.

***6. Que tipo de parceiro externo tem sido usado nas atividades de inovação da sua organização?**

Por favor, selecione **todas** as opções que se aplicam:

- Fornecedores
- Clientes
- Concorrentes ou empresas do mesmo setor
- Consultores, laboratórios ou institutos privados de P&D
- Universidades ou outros institutos de ensino superior
- Institutos de pesquisa governamentais ou públicos

***7. Quais os motivos que levam a sua organização a adotar a Inovação Aberta?**

Por favor, indique o grau de importância dos seguintes motivos:

	Nada importante						Muito importante
	1	2	3	4	5	6	7
Controlo Maior controlo sobre as atividades; melhor organização de processos complexos;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Foco Adequação às competências centrais; foco claro das atividades da organização;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Processo de inovação Desenvolvimento aprimorado de inovações; integração de novas tecnologias; desenvolver inovações mais rapidamente e de uma forma mais eficaz;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conhecimento Ganhar conhecimentos; trazer competências para a organização;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Custos Gestão de custos, rentabilidade, eficiência;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Capacidade Não consegue inovar sozinha; contrabalançar a falta de capacidade;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mercado Acompanhar a evolução atual do mercado; satisfazer a procura dos clientes; aumentar o crescimento e/ou a quota de mercado;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

***8. Na sua opinião, considera que seja/ou seria uma mais valia para a sua organização adotar práticas de Inovação Aberta?**

Discordo Fortemente							Concordo Fortemente
1	2	3	4	5	6	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

***9. Na sua opinião, que tipo de parceiro externo é/ou seria mais importante para desenvolver/implementar inovações juntamente com a sua organização?**

Por favor, indique o grau de importância dos seguintes parceiros externos:

	Nada Importante							Muito Importante
	1	2	3	4	5	6	7	
Fornecedores	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Cientes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Concorrentes ou empresas do mesmo setor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Consultores, laboratórios ou institutos privados de P&D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Universidades ou outros institutos de ensino superior	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Institutos de pesquisa governamentais ou públicos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

ADOÇÃO DA INOVAÇÃO ABERTA NO SETOR DA SAÚDE

PARTE 3: IDENTIFICAÇÃO DA ORGANIZAÇÃO

*10. A que organização de saúde pertence?

Por favor, selecione **apenas** uma das seguintes opções:

- Hospitais
(Ex.: Hospital geral, de saúde mental ou especializado)
- Prestadores de cuidados continuados
(Ex.: Cuidados de enfermagem ou de saúde mental)
- Prestadores de cuidados de saúde ambulatoriais
(Ex.: Consultório médico de clínica geral ou de medicina mental, clínica dentária, centros de saúde ambulatoriais, outros profissionais de saúde independentes como fisioterapeutas)
- Prestadores de serviços auxiliares
(Ex.: Prestador de transporte de pacientes, laboratório médico e de diagnóstico)
- Grossistas e outros fornecedores de produtos médicos
(Ex.: Farmácia, vendedor ou fornecedor de produtos médicos e farmacêuticos)
- Prestadores de cuidados preventivos
(Ex.: Instituto de saúde pública ou de medicina no trabalho, agência sanitária)
- Prestadores de serviços de administração e financiamento do sistema de saúde
(Ex.: Agência governamental de administração da saúde, agência de seguro social de saúde, agência de administração de seguros de saúde privados)
- Outras
(Ex.: Prestador de cuidados de saúde domiciliários ou de cuidados de saúde secundários, indústrias envolvidas no fornecimento de equipamentos médicos, na pesquisa e desenvolvimento em saúde ou na educação e formação de profissionais de saúde)

*11. A que setor pertence a sua organização?

Por favor, selecione **apenas** uma das seguintes opções:

- Público
- Privado
- Social

*12. A que região pertence a sua organização?

Por favor, selecione **apenas** uma das seguintes opções:

- Norte
- Centro
- Área Metropolitana de Lisboa
- Alentejo
- Algarve
- Açores
- Madeira

ADOÇÃO DA INOVAÇÃO ABERTA NO SETOR DA SAÚDE

PARTE 4: IDENTIFICAÇÃO DO FUNCIONÁRIO

***13. Que função exerce na organização?**

***14. Sexo:**

Por favor, seleccione **apenas** uma das seguintes opções:

- Feminino
- Masculino

***15. Idade:**

Por favor, seleccione **apenas** uma das seguintes opções:

- Até 21 anos
- 22 a 30 anos
- 31 a 40 anos
- 41 a 50 anos
- 51 a 60 anos
- Mais de 61 anos

***16. Qual o seu grau de conhecimento relativo ao modelo de Inovação Aberta?**

Terrível							Muito Elevado
1	2	3	4	5	6	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

