Open source innovation: what makes it move?

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Abstract: The way organisations conduct their innovation processes has advanced in recent years, evidencing open innovation as an object of study. Von Hippel (2005a) introduced an even more radical innovation concept called Open Source Innovation (OSI), characterised by an opening of the innovation process and its results. In this scenario, we explore the adoption of OSI approach by several organisations and pose the following question: What moves open source innovation initiatives? We conducted field research with international companies that used the OSI approach. Empirical evidence enabled us to address the research question by confirming previous motivations reported in the literature, integrating them into two newly identified backgrounds and unveiling a highly strategic aspect of the adoption of OSI as a business model. Our main contribution is the analysis of open strategies beyond the software industry, paving the way for significant progress and the development of new theories on this topic.

Keywords: open source; innovation; open innovation; strategy; open strategy.

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1 Introduction

In recent decades, organisations have become more complex, especially in regard to the research and development (R&D) of new products. R&D now requires knowledge and skills that, in most cases, are no longer available within the borders of a single organisation (Hui et al., 2008). Therefore, companies need to seek new funds through a series of collaborative relationships with external agents. In 2003, Chesbrough published an article arguing that organisations must move towards an open innovation approach, in which R&D departments are no longer the only source of their innovation. The author stressed the importance of a model that, through a collaborative and open process, enhances the flow of information with the external environment.

It is important to note that the concept of 'open and collaborative', as presented in the literature, refers not only to the processes, practices and models of innovation but also to a new paradigm or new strategy for how organisations should conduct their innovation processes. Open innovation, as a strategy, can be supported by some different shapes, designs, and development processes of new products or services. Innovation networks, crowdsourcing, joint R&D projects, co-creation projects and many other forms of alliances for R&D – either in dyads, triads or multi-actor networks – are structures to support open and collaborative innovation strategy (Koch, 2011). One of these models to open the innovation process in a more radical way is called the open source innovation (OSI) (Von Hippel, 2005a; Belenzon and Schankerman, 2015).

OSI is similar to what Von Hippel (2005b) called 'innovation communities' and Shah (2006) called 'community-based innovation'. In contrast to the proprietary model, the model based on community does not include exclusive property rights or hierarchical controls; rather, it is based on the open, volunteer and collaborative efforts of products users in its development. Through OSI, innovative products and services are produced by

volunteers who offer their solutions without appropriating returns from the sale of their proposals. Examples of this phenomenon include software development (Linux, Apache, Debian or Mozilla), content creation projects (Wikipedia, LibriVox, Open Directory Project or Open Street Map) and even the development of hardware (Arduino). This open process and open results that characterise OSI is the main focus of this study.

Among the different levels of openness of the innovation process that support open innovation strategy, OSI model presents characteristics and motivations that indicate other nuances involved in its adoption. The OSI is more radical than open innovation approach not only by making the process more open but also by opening the results of innovation (Huizingh, 2011). The advances from this opening challenge some of the basic and traditional principles of business strategy (Goldman and Gabriel, 2005), creating a new innovation scenario (Dabrowska and Savitskaya, 2014; Chase, 2015). Although OSI has emerged focused on the software industry – a pioneer industry in the adoption of open standards (Bonaccorsi and Rossi, 2004; Füller et al., 2013) some surveys indicate that the interest in the topic has been growing beyond software area (Euchner, 2010; Huizingh, 2011) and may soon pervade business innovation strategies in different spheres (Ikeda and Marshall, 2016).

The literature has been deepening the debate on OSI (Krishnamurthy, 2006). The author such as Huizingh (2011) has indicated the need for more empirical studies, particularly for more heterogeneity in the units of analysis (Belenzon and Schankerman, 2008; Parida et al., 2012; Blohm et al., 2013; Wynarczyk, 2013). In this way, the article aimed to broaden the empirical studies on OSI, contemplating a greater multiplicity of business segments, confronting the reasons exposed in the literature. Could there be underlying motivations in the adoption of OSI besides the previously identified? We posit that there are.

Among the different questions that still require more robust explanations and therefore further studies, one, in particular, was the guideline for the article in question: What moves OSI initiatives? By 'moving', we mean the reasons and motivations that have led companies to adopt this open innovation model, i.e., the background of the OSI, featured here by the benefits and advantages of the model and the reasons justifying its selection. To answer the research question, an exploratory study was conducted with managers of seven companies that base their business on the main premises of OSI and that target markets in electronics/hardware, education and software development. We conducted in deep interviews with these managers, in-person, by e-mail and skype to understand what really drives their choice by an OSI business. Three contributions of this study stand out. The first relates to the heterogeneity of the field. In contrast to previous OSI studies, this article is not limited to the software industry, expanding into other areas where this approach has begun to emerge and succeed. Furthermore, this research covers the context of small and medium-sized enterprises (SMEs), where open innovation "is an under-researched topic that needs further attention from researchers in technology and innovation management" [Parida et al., (2012), p.303]. The second contribution is the evaluation and identification of the reasons why different companies adopt OSI – the model whose degree of openness is the most radical – as their business model, moving away from the simple ideological or altruistic arguments of its practitioners. Finally, the article shows that there is room for significant improvements in new theories in the organisational field via an understanding of open models of strategies, which breaks some of the traditional principles of management.

To achieve the proposed goals, this paper is organised into six sections, beginning with this introduction. Section 2 discusses the origins of the open innovation concept and deepens the literature on OSI. In Section 3, we present and discuss the motivations for OSI adoption pointed out in the literature. In Section 4, the research method is detailed. Then, we present the analysis and discuss the results of the research that underlies the debate about the managerial implications of adopting OSI. Our final considerations and limitations of the study are pointed out, along with future research possibilities that conclude the paper.

2 Open source innovation

Under the umbrella of open innovation, many different approaches with varying degrees of openness analyse the innovation process and its results. As shown in Table 1, innovations with closed processes and results (quadrant 1) reflect a situation in which an innovation is developed and patented internally. In this case, both the process and the results are closed. In quadrant 2, the results are closed (innovation is the property of a person or organisation), but the process relies on external partners participating at some point in the innovation process. Much of the open innovation studies fit into this quadrant (Huston and Sakkab, 2006; Bueno and Balestrin, 2012; Parida et al., 2012; Blohm et al., 2013; Wynarczyk, 2013). Some of these studies even use the number of company patents as an indicator of success, e.g., Ikeda and Marshall (2016). Such an approach is known as private open innovation because the results of the innovation are the exclusive property of the companies. Quadrant 3 includes innovations developed privately and made available publicly. Finally, the fourth quadrant represents the highest degree of openness, in which innovations are designed and developed in an open and collaborative manner, being their results publicly available. This approach is known as OSI (Huizingh, 2011).

Table 1 Innovation approaches based on the degree of the openness and the results of innovation

Innovation process	*Innovation results*			
	Closed		*Open*	
Closed	1	Closed innovation	3	Public innovation
Open	2	Private open innovation	4	Open source innovation

Source: Adapted from Huizingh (2011)

Open source software is still the best-known example of the quadrant 4 (Koch, 2011), but surveys indicate that interest in the OSI model is increasingly growing, extending beyond the software area (Huizingh, 2011; Euchner, 2010). "Economic research indicates that it may soon dominate corporate innovation in a steadily increasing number of fields" [Euchner, (2010), p.7]. In 1988, Von Hippel proposed that the greatest source of innovation in a company lies in its customers and users. Based on this proposal, in 2003, Chesbrough developed his concept of open innovation, defined by innovation processes in which companies interact extensively with the environment, leading to a significant amount of exploitation of external knowledge. The central elements of the open innovation concept suggested by the author are the increased profitability and speed of

the innovation process, made possible by funding the innovative ideas of customers and users willing to cooperate.

In parallel to Chesbrough' studies, authors such as Von Hippel (2005a, 2005b) and Euchner (2010, 2013) noted the existence of two significantly different types of open innovation. One refers to Chesbrough's understanding on open innovation, which operates within the current and traditional management paradigm, in which the organisation, through intellectual property, has absolute control over the process and results of innovation. The other kind of open innovation goes further, offering an extensive understanding of the ways in which community contributions can add value (Euchner, 2010, 2013). In summary, the approaches under the umbrella of the open innovation model have in common the assumption that good ideas can come from inside or outside an organisation. However, they differ regarding the degree of necessary and desired openness. The OSI allows a large community of innovative and sometimes anonymous users not only to generate ideas but also to jointly develop them and benefit from their results. Open innovation, in this context, refers to an open initiative and direction and thus moves beyond the traditional business model (Euchner, 2013), representing a distinct way to innovate and produce goods and services (Levine and Prietula, 2010).

Although OSI shares some of Chesbrough's assumptions on open innovation, it relies on a different paradigm (Euchner, 2013; Dabrowska and Savitskaya, 2014), and this may be one of the reasons why so many companies still ignore it. However, Baldwin and Von Hippel (2011) indicated that OSI can come to dominate other types of innovations quickly and at decreasing costs, since it finds in collaborative digital platforms (particularly the internet) its foundations in favour open rather than proprietary knowledge. Thus, OSI brings benefits for the business innovation process, making it open, more streamlined, less costly and less risky, which can be some of the reasons of why managers and entrepreneurs adopt it. The next section presents the advances in management literature addressing these motivations.

2.1 Motivations for OSI

According to Chesbrough and Appleyard (2007), the theoretical assumptions hitherto developed in the organisational field are not enough to explain the emerging empirical phenomena in technology-based industries. The lack of widely recognised assumptions that cover the particularities of the OSI and explain the motivations and performance of this model make it difficult to understand the growing economic impact that it entails (Euchner, 2010; Battistella and Nonino, 2013). Despite this gap, the organisation of motivational categories that cover the different possible benefits of companies' adoption of OSI allows a deeper understanding of the expansion of this phenomenon into various sectors.

The motivations to engage in OSI projects have been studied by scholars of technological fields. In the context of the software industry, Belenzon and Schankerman (2015) identified four major motivations shared among professionals. The first motivation is intrinsic since the developers contribute to OSI by identifying themselves with the logic behind the initiative, improving their reputation through the greater recognition of their peers (Raymond, 2001). A second reason of why professionals participate in OSI communities is to achieve larger economic rewards in the labour market (Johnson, 2002, 2006; Lerner and Tirole, 2001, 2002), while a third motivation is

a possibility of having and using reciprocal contributions (Lakhani and Von Hippel, 2003). Finally, they also observe the simple enjoyment of being involved in projects as if they were a hobby, in which the marginal utility of effort can be positive (Shah, 2006). Following the same line, Battistella and Nonino (2013) identified the collaborative innovation processes being one of the most important motivations that attract users to proactively participate and contribute to OSI. Their study focused on 26 web-based platforms and offered an analysis of the elements that motivate the adoption of open innovation model as a business model in the corporate domain. Their findings suggest other motivations such as individual intrinsic motivations (opportunity to express individual creativity, sense of membership, enjoyment, psychological compensation and feeling of efficacy); professional extrinsic motivations (learning and reputation); social intrinsic and extrinsic motivations (sense of cooperation in the area of interest). Although those studies have provided different pieces of evidences, they have two major limitations in relation to the research on OSI. First, they are based mostly on the field of software; second, their units of analysis are restricted to individuals belonging to an OSI community and not on the companies that operate with this model.

We have expanded the analysis units contemplating other areas in which this approach has already begun to emerge and succeed (Belenzon and Schankerman, 2008). The creation of new business models, motivated by harnessing collective creativity through OSI, stimulates a reinterpretation of the traditional view of strategy, which guides companies to develop defensible positions against the multiple forces of competition (Chesbrough and Appleyard, 2007; Koch, 2011). Koenig (2004), for example, illustrated seven types of strategies that can be found in OSI-based models used to promote innovation, add value to a product, attract customers and generate revenue. These strategies include optimisation, dual license, support, consulting, sponsorship, host and incorporation. Optimisation relates to the modularity and adaptability that OSI projects enable, once the created portability implicitly guarantees that customers will not be tied to a single hardware vendor and operating system (*lock in*). The dual license, derived from software templates, is characterised as a freemium alternative – i.e., while providing certain basic features for free, there is also a paid alternative, with extension possibilities and solutions to the product. The support strategies and advice are under the same umbrella: while the product itself is based on OSI, the monetisation means of the company are supported by consulting, engineering and training (Koenig, 2004).

Sponsorship and host also emerge as attractive alternatives to companies that want to invest in the OSI model with the goal of obtaining future gains through the expected standardisation of a certain technology, the contributions arising from the community or even the improvement of their deliverables with *cost reduction* (Baldwin and Von Hippel, 2011). Finally, the incorporation can be translated as a market penetration initiative because the free distribution enables the company to gain space, combining the issue of cost with aspects such as stability, simplicity, and networking.

Focusing on companies, Goldman and Gabriel (2005) noticed that *reduction of the time* required to take the product to market is another reason why companies engage in OSI. They also observed that transparency in the development process, contrary to imprisonment of knowledge, strengths relations with partners and customers. Such *loyalty* motivates companies to adopt OSI (Goldman and Gabriel, 2005), allowing companies to direct their investment more to areas of development than to commercial areas, as observed by Koenig (2004). Thus, openness also contributes to the company's

marketing. According to the Goldman and Gabriel (2005), brand positioning, the creation of new markets and close relationships with partners and customers are factors that motivate the adoption of OSI by companies.

Based on this literature, motivations were organised into five general categories: time, lack of lock-in, cost reduction, loyalty and indirect marketing. Table 2 provides a literature summary of the motivations that drive companies to adopt OSI, developed with the purpose of facilitating the analysis of the evidence in the study.

Table 2 Motivations that lead companies to adopt OSI

Motivations	*Definition*	*Authors*
Time	Reduced time to bring an innovation to the market.	Goldman and Gabriel (2005), Chesbrough and Appleyard (2007), Baldwin and Von Hippel (2011), Ikeda and Marshall (2016)
Lack of lock-in	Factors contrary to the lock-in (imprisonment of knowledge by the supplier, resulting in clients often becoming their hostage) result in the trust and satisfaction of a larger number of clients.	Goldman and Gabriel (2005), Koenig (2004)
Cost reduction	Building on the work of others more directly, allowing voluntary participation of stakeholders and users in the development process, enhancing problem-solving capacities and improving performance.	Baldwin and Von Hippel (2011), Parida et al. (2012)
Loyalty	Transparency in the development process and the strengthening of relations with partners and customers favour loyalty.	Goldman and Gabriel (2005)
Indirect marketing	Openness provides free visibility, allowing companies to direct their investment more to areas of development than to commercial areas.	Goldman and Gabriel (2005), Koenig (2004)

Source: Elaborated by the authors

As shown in Table 2, we categorise five core motivations for the adoption of the OSI arising from the literature reviewed. These categories represent a summary of the theoretical assumptions that form the basis for the data collection and analysis in the empirical study. The methodological procedures used in conducting the research are outlined in the next section.

3 Methodology

This study is characterised as an exploratory study, and the unit of analysis consists of senior management professionals of companies that base their business models on the main premises of the OSI model. Initially, two approaches were adopted to identify companies that corresponded to the profile desired for the research, i.e., companies that contemplated the OSI model at their core. First, we researched the internet, targeting sites related to the subject (e.g., http://www.ohwr.org) for lists of companies that are based on this model, and we performed Google searches for open source sectors that were not software companies. Second, we spoke to members of the OSI community who are

experts in computers, physics, and electronics, requesting information from national and international companies to adopt open models of innovation. In this initial phase, 24 companies were identified – three national and 21 foreign – and all of them were invited by a manager to participate. The invitation was sent by e-mail, social network platforms and, as a last resort, through the 'contact us' link from their respective websites.

Of the companies identified, seven agreed to participate either through an in-person interview or by sending the duly completed questionnaire. These organisations belonged to different sectors, by accordance with Belenzon and Schankerman (2008) and Huizingh (2011), which suggested conducting OSI empirical studies not only in the field of software. Data were collected via in-depth interviews, and the collection instrument was a semi-structured interview script with open questions (Creswell, 1998). Respondents of Company A were collectively interviewed in person at the company's headquarters. Representatives of Companies B and C were interviewed via video conference, and respondents of the foreign companies (D, E, F and G) responded to the script questions via e-mail and social network platforms. Data was collected in the second half of 2015. To protect participants' identities, companies' names are not revealed and are identified by letters. The participants included nine respondents from seven companies, as shown in Table 3.

Table 3 Research participant companies

Company	*Market*	*Lifetime (years)*	*Number of employees*	*Interviewees*	*Nationality*
A	Software/education	3	8	Two associate founders one developer	Brazil
B	Electronic equipment	1	4	One associate (founder)	Brazil
C	Special electronic projects	2	13	One associate (founder)	Brazil
D	Electronic equipment	13	140	One CEO	USA
E	Software	17	112	One vice president	USA
F	Software	14	140	One CEO (founder)	Slovenia
G	Hardware	20	30	One developer engineer	Spain

Source: Elaborated by the authors

The categories identified in the literature review and summarised in Table 2 formed the basis for analysing the motivations of companies' adoption of the OSI model, listed in Table 3. The script, which was exploratory in nature and prepared based on the reviewed literature, consisted of three blocks. The first block aimed to form an understanding about the company, e.g., its activities, business, business sector, target audience and competitors. Moreover, the interview stage included the presentation of the concept of the OSI model and the interviewee's confirmation of the adoption of this model. The questions in the second block were prepared to identify the reasons why companies had

adopted the OSI model and the advantages perceived by the respondents. The third block sought to understand how the results of this choice were reflected in business management. These topics shaped the interviews (which were recorded and transcribed, in the case of Companies A, B and C) and formed the basis for the construction of the questionnaire sent to participants of foreign companies.

The interview script was built on a semi-structured approach consisting of open questions that provided great detail on respondents' answers and reinforced the exploratory nature of the study. Within this scenario, it was possible to explore new categories of analysis in the field of motivation and the managerial implications that arise as the result of its adoption. The information gathered was analysed using the content analysis technique through categories of analysis (Neuendorf, 2016), which were segmented into two large blocks: motivations for the adoption of OSI (perceived benefits) and the results of the OSI (developments in companies' strategy).

4 results presentation and discussion

Evidence collected from the seven companies enabled us to understand the motivations and strategic consequences of OSI adoption. The information was categorised as shown in Table 2, which summarises the motivations highlighted in the literature. First, we assessed the reasons why the interviewed companies opted for the adoption of OSI at the expense of traditional models of intellectual property. Subsequently, the results achieved with the adoption of the OSI model and its impact on the strategy of the companies surveyed were analysed.

4.1 Motivations for OSI adoption

When they were invited to talk about the reasons that led to the adoption of OSI as a business model, respondents from Companies B, E and G reported past failures with the initial adoption of the traditional closed model. The founder of Company B, reflecting on the grounds that once led to bankruptcy, said, "The closed model hurt me a lot. It delayed and hindered the development of products. I could not freely exchange ideas and learn from others about a particular technology because it was closed". His report is aligned with the study by Levine and Prietula (2010), in which the ability to openly build on the work of others was described one of the benefits and advantages of OSI over traditional model innovation.

The trajectory of the Companies B, E and G shows that the advances of the openness present in the OSI represents a paradigmatic change that gives rise to a new scenario of innovation (Dabrowska and Savitskaya, 2014; Chase, 2015). The vice president of Company E reported that initially his company operated with a hybrid model, and when he realised that the revenue from OSI projects was growing in a greater proportion, he eventually adopted it as standard business model.

> "We could have chosen to grow using a traditional business model. However, it would not be as big as it is today, and we would have a far larger percentage of marketing/sales employees on our staff (and therefore fewer developers)." (Company E)

The visibility and the gains with indirect marketing also served as a reason for Company G, which did not invest in marketing and, as Company B did, experienced failures in the adoption of the traditional model. "The open source scheme has allowed us to collaborate with large scientific facilities (universities and research centres), which have given us visibility" (Company G). In general, it was observed that effective and low-cost marketing proved to be a strong motivation for the adoption of OSI. According to Koenig (2004), it is clear that indirect marketing in OSI initiatives is closely related to activities of support, consulting and mergers; this is reflected in the response of one of the founders of the enterprise:

> "Customers come to us, instead of us having to run after them. Some are not interested in buying, some just want to use, but from the use, they may want to hire a service. It is a value that would not exist if the model was closed." (Company A)

The visibility factor was cited by as a reason for adoption by companies that aimed for larger gains via integration with the OSI community:

> "We think that the gain in joining the OSI community would be much greater than if we just did our work in an isolated way because, from the beginning, we had a lot of visibility due to the open source." (Company A)

Reputation and peer recognition were sought and valued not only by individuals, as evidenced by the work of Raymond (2001) and Battistella and Nonino (2013), but also by organisations that are part of the OSI community (Belenzon and Schankerman, 2015). Another reason highlighted by Company A was the lack of resources to start its activities: "There was no capital to develop, in a short time, a solution that offered a very visible difference" (Company A). In this scenario, the selection of a completely open approach was successful, considering that this opening is currently the main distinction factor of the company in the market in which it operates.

Although open innovation studies are focused primarily on older companies or medium and large companies (Wynarczyk, 2013, Parida et al., 2012), our results clearly demonstrate that OSI is not restricted to this type of organisation. In the context of SMEs (such as Companies A, B and C), the choice of the most radical degree of openness has translated into a strategy to achieve competitiveness and remain competitive in the global market.

Changing the property focus to the concept of transparency requires rethinking the processes that are the basis for the company's creation and capture of value (Goldman and Gabriel, 2005; Ikeda and Marshall, 2016). In this sense, the founder of Company C expressed his disbelief in intellectual property:

> "To expect that just because you have a patent, no one will copy you is pure innocence! In two weeks, there will be a Chinese guy copying that wonderful project you did and that took ten years studying, and at the end, you end up closing, understood? When you close a technology, you close a code, you close an idea, you are imprisoning yourself." (Company C)

The manager's point of view shows that the reasons for adopting the open model are related to the intention to remain open to contributions, to obtaining visibility, or even to gaining agility, because the opening ensures a significant reduction in the time required to launch an innovation and marketing it (Baldwin and Von Hippel, 2011; Goldman and Gabriel, 2005).

The findings of this research reinforce that innovation is increasingly happening within the economy of everyone-to-everyone (E2E), which implies a fundamental change in mindset from 'me' to 'we' (Ikeda and Marshall, 2016). The intellectual property, which once occupied a central position in the field of strategy, is in the periphery of OSI design (Goldman and Gabriel, 2005), causing innovation to be approached differently by an increasing number of organisations (Ikeda and Marshall, 2016). The Companies D and F reported that the reasons for adopting a fully open model were directly related to the markets they operate (teaching and research). Whereas the CEO of Company D stressed the taste for teaching, the CEO of Company F stated his reasons in an objective and clear way:

> "Our customers are (inter) national research laboratories that are used to open share their results. They have already negatively reacted to some of our competitors who tried to keep their IP closed. But they are happy to pay for the work that we do, as long our results remain open source." (Company F)

In the E2E economy velocity and flexibility are the determinants of successful innovation (Ikeda and Marshall, 2016). In this sense, the findings of this research show that the surveyed companies looked for opportunities in the OSI model to improve their performance in less time. According to Levine and Prietula (2010), what distinguishes the basis of OSI from the basis of traditional innovation are the advantages and unique benefits of the former. When asked about the benefits and advantages derived from OSI, respondents mentioned seven general motivations. Table 4 summarises these motivations in order of importance (from advantages cited by the most companies to the least) and relates them to the reviewed literature on the subject.

This study confirms that OSI operates as a different model to innovate and produce goods and services. There are several differences that stand out compared to the traditional model of innovation, but we highlight the time factor – the most cited motivation for the companies surveyed – as the main motivation for adopting a model that, according to Chesbrough and Appleyard (2007), does not consider ownership and control as levers for success.

Table 4 Motivations leading to the adoption of OSI, according to evidence collected

Motivations	*Mentioned by companies*	*Mentioned by authors*
Time	A, B, C, D and G	Goldman and Gabriel (2005), Chesbrough and Appleyard (2007), Baldwin and Von Hippel (2011), Ikeda and Marshall (2016)
Lack of lock-in	A, E and G	Goldman and Gabriel (2005), Koenig (2004)
Cost reduction	A, C and G	Baldwin and Von Hippel (2011), Parida et al. (2012)
Loyalty	A, D and G	Goldman and Gabriel (2005)
Indirect marketing	A, E and F	Goldman and Gabriel (2005), Koenig (2004)
Competitive distinction	A, D and F	-
Easiness to hire new employees	A	-

Source: Elaborated by the authors

The largest impact of OSI seems to be related to the speed of the innovation process (time), which, far from the moorings of the traditional model, is associated with strategies based on collaboration, sharing, learning and cooperation, as evidenced by the statement of Company A founder:

> "If we did everything here, we would be much slower. The way it is today, we can focus on certain points that are strategic for our business, while others are working on other things, such as stability and functionality."

This claim shows that the time to develop a new solution (related to either software or hardware) is much shorter when developed from other solutions shared by the opening that OSI provides. The lack of lock-in – also the result of transparency in the development process, a typical feature of this model, according to Goldman and Gabriel (2005) – concerns what Koenig (2004) meant by optimisation strategy, i.e., the enabled portability that gives customers the guarantee that they will not become hostages to a single supplier. In the words of a member of Company G, when "the competence is open, the prices will not be unilaterally driven by the company. Support can be given easily by this company and also by other partners".

At first glance, the lack of lock-in may seem to be a benefit that is more reserved to customers than to companies, as expressed a Company E's respondent:

> "Some customers have been burned basing their product/workflow on commercial tools. Increasing license fees and prohibitive restrictions can put that customer in a tough situation where they must keep paying escalating fees or abandon their existing tools (and whatever expensive customisations they paid to have implemented)."

However, this feature of the OSI model was the second most cited benefit by respondents, who recognised it as a winning opportunity for all: "There is that thing that the consumer notes that this opening is a positive feature in the companies; it facilitates building a customer trust relationship with the supplier" (Company A).

The reduction in development costs was widely evidenced by the companies surveyed. This reduction is closely related to the time factor since the economy is both of resources and time when an open style is used. In the case of SMEs, the study by Parida et al. (2012) shows that open innovation practices can positively influence the innovative performance of these companies. In doing this research with companies that adopt the OSI, we verified that this model allows the sharing of resources and the optimisation of costs in the process of innovation, being this much-mentioned advantage by SMEs researched. This point highlights the importance of removing barriers to entry, allowing users to contribute as much as they want, and increasing the capacity for innovation and problem solving:

> "If we developed in a closed way so we had to do everything, we would need to have people making tests all the time, people developing all components. The way it is today, we count on the work of other companies, for example, that are in the same situation that we are now, who are developing strategic parts for them that are different from ours, and at some point, everything is integrated." (Company A)

The statement suggests that engaging with other companies in an open and collaborative way can improve performance via alignment with the paradigm represented by OSI (Ikeda and Marshall, 2016). In this sense, satisfaction and customer loyalty come from a

participatory and well-informed clientele. Companies A, D and G agreed that providers of 'good and open support' gain prestige in this predominantly private system, in which customer support takes place only in a bilateral relationship. In turn, indirect marketing was evidenced not only as a motivation restricted to firms in the OSI community but also as an advantage enjoyed by their members:

> "As the company has certain marketing with this, the person also has it. All the work we do is not only linked to the company, but it is also linked to our name. Then, at an individual level, this is very cool, and we pass this idea along to others." (Company A)

In this sense, integrating an OSI community can enhance reputation through greater peer recognition and greater commercial rewards in the labour market (Lerner and Tirole, 2001, 2002; Johnson, 2002, 2006).

Although not found in the reviewed literature as an advantage of the OSI, Companies A, D and F noted that the adoption of the model also represented a factor that differentiated them from other companies, serving as their main competitive advantage in the market in which they operated. According to the companies that highlighted the model as a competitive advantage, there is a growing audience reporting that, when choosing the supplier of a certain technology, they prefer those that operate openly instead of the ones that keep their development process secret. "If two products are functionally identical, but differ only in that one is open source and one is closed source, an informed consumer can see the advantage of full information being available for the open source product" (Company D).

In this sense, Company A listed commercially available products that are functionally similar to theirs and highlighted: "Maybe the model of open source is really the biggest difference" (Company A). According to Chesbrough and Appleyard (2007), in a competitive environment, each organisation or entity attempts to gain the advantage by producing things that are different from what others produce, aiming to obtain a distinction. However, this identified antecedent shows that some companies have sought this difference not only in products but in the process of developing and offering/sharing the products on the market. The reviewed literature does not address OSI as a possible distinction of a company, so this evidence has emerged as a new motivational antecedent that deserves to be explored and developed further in future studies on the topic.

Finally, the ease of hiring new employees was a motivation mentioned only by Company A. This company's respondent indicated that the investment in training is low because the technologies used in the open model are generally disseminated among those involved such that there is no need for training someone on a specific and secret technology. As stated by the respondent of that company, "Finding people that integrate with the company's values also becomes easier when it operates openly". Koenig (2004) and Goldman and Gabriel (2005) listed a number of reasons why companies engage in OSI; however, they did not mention the facility of training staff or selecting and hiring employees more quickly and assertively. Although this motivation has appeared in only one of the researched companies, it represents a research opportunity in this area.

The identification and analysis of the OSI background explained an eminently strategic facet. This facet – which is little studied in the literature – emerged as an underlying factor of the motivations that led companies to opt for this business model. All seven companies surveyed, without exception, envisioned that the OSI opportunities would help improve their performance in the shortest time. Thus, the strategic nature of

the adoption of OSI is shown in the following subsection, dedicated to an in-depth analysis of this finding, which responds to the research problem of this work.

4.2 Unveiling the strategy of OSI

In his article published in 1996, Porter asked, "After all, what would strategy be?". According to the author, the success of a company derives from a competitive position that will lead to higher and sustainable performance. Many other perspectives and approaches have also proven fruitful in understanding business strategy (Nag et al., 2007; Nerur et al., 2008). However, according to Chesbrough and Appleyard (2007), none of them can fully explain emerging empirical phenomena such as the adoption of OSI practices in industries, especially technology-based ones. The assumptions of traditional strategic perspectives are based on ownership and control as higher performance and sustainable foundations. In general, they do not ascribe importance to the potential value of external resources that are not in a company's possession but could create value (Chesbrough and Appleyard, 2007). As indicated by the two authors, some companies have been shown to be building open strategies. Thus, following the calls for more empirical studies, the surveyed companies were asked about the relationship between the OSI model and their business strategies. Unanimously, the seven surveyed companies said that the decision to open and share the results of their innovation process was a strategic choice: "The adoption of the OSI is a major advantage that the company has in the market in which it operates. Because we have many other companies that do essentially the same thing we do, our biggest distinction is to be open" (Company A). This statement reveals the adoption of the open model for strictly strategic directions. We did not observe respondents highlighting ideological or altruistic reasons behind the choice.

Also, companies related the different OSI advantages to their strategy, particularly with regards to the speed of innovating and improving performance:

> "The adoption of OSI is characterised as a business strategy for the company because it is a way to create things at a much faster speed, so we take this pioneering spirit to conquer a market in which the largest companies have yet to arrive." (Company B)

The speed at which to offer an innovative product or service in the market, called 'go to market', was highlighted by Goldman and Gabriel (2005) as one of the reasons why many companies have adopted OSI. According to these authors, the strategic opening allows them to start with the delivery of a relatively low-quality product, just good enough to fulfil its purpose, and then to follow up with long conversations with consumers to determine what types of features and levels of quality are really necessary to improve (Goldman and Gabriel, 2005).

In this open strategy logic, the respondents showed that OSI can generally be considered a way to gain visibility and recognition quickly and cheaply. Aspects such as credibility, reputation, and image building were cited by respondents, corroborating the view of Chesbrough and Appleyard (2007), who advocated in favour of the OSI model as a means to compete and cooperate. Thus, it is based on an open strategy that can also differentiate and provide greater competitiveness by being collaborative, where the community shares the process and the results of innovation.

Through the reports, we also identified activities mentioned by Koenig (2004) for client attraction, such as mergers, which ultimately add value to the products and services being developed and offered:

> "A closed source business model encourages companies to fiercely protect past innovations, and instead of concentrating on the future [...]. The open source business model encourages a loyal and informed customer base, as the company's customers have the opportunity to participate in the development of the open source business' product development." (Company D)

According to Koenig (2004), we notice the use of strategies aiming for gains associated with developed products and services, such as support, training and consulting services, as evidenced by the main monetisation of Companies B, C, E, F and G. In the strategic management of the surveyed companies, the adoption of open practices derived from OSI reveals new possibilities for research on strategy to address the emergence of a reality in which the search for competitive advantage has happened differently from the traditional model.

Goldman and Gabriel (2005) stated that 'the old model' is becoming broken. The authors noted that while research on intellectual property to innovate still makes some sense, it is important not to stop looking outside of the internal boundaries of a company. Incorporating the OSI model as part of an open business strategy requires questions about property rights and control over the technology. Contributing to the affirmation of the adoption of OSI as a strategy, Company A's respondent detailed his views on the issue:

> "Today, innovation is no longer that kind in which [...] a company will innovate with something wonderful and magical and will become a market leader and end with all other companies. Innovation is well distributed, so each company invents a mini thing. So if we were a closed company, we would be one more in a sea of the many similar companies. In our case, we would be a minuscule fish in the middle of millions of large fishes." (Company A)

In sum, the findings of this study suggest that when shifting the focus from property to the concept of transparency, a company ends up reviewing its processes of the creation and capture of value. The results of OSI have challenged some of the basic principles of the traditional view of strategy. Aspects that once were of central importance, such as intellectual property, barriers to entry, switching costs and industry rivalry, are of secondary importance in the genesis of the phenomena triggered by OSI. Forces that were peripheral, or even totally ignored, such as the participation of volunteers, communities, networks and innovation ecosystems, become essential in an open strategy design. The change that OSI brings is related not only to the management model but the market as a whole. We, therefore, show that the open strategy proposed by the OSI model empowers companies to change their own competitive game.

5 Concluding remarks

The logic of the traditional business model, oriented to internal R&D and built purely on gains from intellectual property, is succumbing before the emergence of new technologies and new forms of management. Open innovation and, in particular, OSI establish a business dynamic focused on sharing ideas, joint knowledge and experience, not restricted to a company's limits. Thus, a new way to create value is established,

shaping up as a strategic alternative. Precisely because of the paradigm shift that it represents, OSI also brings with it challenges to overcome in its implementation because the approach cannot be sustained only as a mechanism to reduce costs. A careful analysis of its adoption is required.

Considering the call for more diversity in empirical studies on OSI, this research is not limited to the software industry. It extends the thematic field of studies to companies operating in sectors little explored or unexplored through this perspective. In this sense, diversity is embraced here as an important contribution to better understand the dynamics of this model. The contributions of this study allow advances in the understanding of OSI with evidence on the motivations for adopting the model, such as the shorter introduction of innovative solutions to the market, reduced development costs, marketing earnings, and visibility, and customers' and users' increased satisfaction and subsequent loyalty.

The main contribution of the paper can be descrited by adding two new motivations for choosing the OSI approach: competitive advantage and the ease of hiring employees. This set of motivations and, in particular, evidence of the OSI as a distinction feature reinforce the last contribution of the study: more than an ideology that operates under the umbrella of cultural conventions, OSI is presented as an open business strategy. Thus, what moves OSI initiatives are motivations with a strategic nature, those that break from the logic of traditional strategies. This finding paves the way for new advances in the organisational field because the assumptions of strategic openness have not been used extensively in the scientific literature.

This study, like others of the same nature, has limitations arising from the methodological choices made. Among them, we note the small number of companies surveyed, even if they were international. Additionally, data from some respondents were collected through written responses, reducing the wealth of details of their statements and therefore the analysis of the results.

Despite its limitations, the research findings reflect the possibility for future studies to address the issue through the lens of strategy and as a source of 'coopetitive' distinctions by involving the collaboration feature of OSI in the keynote of business competitiveness. Although this study includes diverse sectors in the debate on the adoption of open business models, it is appropriate for new studies to focus on more traditional sectors, such as basic industry, to verify that such a phenomenon can be found there. In this same sense, a more robust sample is also strongly recommended. Finally, the article can show an important managerial implication: it emphasises that the OSI is not about finding new and better ways to grow the current business formats; it represents a process that leads to business strategy to meet a market dynamic in which the boundaries of the enterprise are becoming less defined.

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