

FACTORS TO HELP DECIDING WHEN TO USE OPEN INNOVATION: FRAMEWORK AND APPLICATION

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Abstract

Open innovation happens when a company combines internal with external resources to develop new products, processes or services. This innovation strategy has the advantage of integrating the strengths of the partners, thus contributing to a higher level of quality and differentiation, lower costs and better timing. However, sometimes the risks and disadvantages of the openness may reduce the value of the innovation process outcome, or even its feasibility. Therefore, adopting an open innovation strategy depends, among other factors, on the ability to identify when a company should be more open or more closed. This may vary from a business unit to another within the same company, from an innovation project to another within the same business unit or even depending on the phase of each particular project. The literature on this subject is scarce. Initially, a literature review was conducted to generate a list of decision factors, and then a focus group methodology was applied to improve the model. The focus group was formed by ten executives involved with innovation from Motorola, Embraer, Natura, IBM, Cristália, Brasken, Equinix, Samsung, Accenture and Group Fleury evaluated and discussed the factors suggesting improvements. Then, interviews based on a pre-tested outlines were conducted at Natura, a leading company in Brazil, to test the conceptual framework. The results contributed to address the following questions: (i) Which factors contribute to help managers decide which innovation projects or which parts of the innovation projects should be done internally and which should be done by a university? (ii) Which factors are more relevant to support this decision? The paper concludes with a list of fifteen factors grouped in five dimensions to help the decision of using open innovation. The most important factors were identified. Due to the characteristics of the case study method, the conclusions cannot be generalized.

Keywords: open innovation, technology strategy

1 Introduction

Innovations in products, processes and services, when properly performed, contribute to the competitiveness of the firm, adding value to customers, shareholders and other stakeholders. For these reasons, there is a natural tendency to protect the information that are critical in the development of innovations, seeking to ensure the advantages of being a pioneer to the innovative company. According to Prahalad & Hamel (1990), competition is

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the effort and continuous learning for the development of skills more quickly than the competitors. According to the Oslo Manual (OECD, 2005) innovation is the implementation of a new or significantly improved product or service, process, or organizational method. Some of the leading researchers of Open Innovation (Granstrand & Sjölander, 1990; Gassman, 2006, Chesbrough, 2006; Piller & Walcher, 2006; Huston & Sakkab, 2006) point out the advantages from the search for external knowledge to innovate in products and processes, such as the reduction of financial risks and the better use of the skills of the organizations involved. Chesbrough (2006) defines open innovation as the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively.” Lli et al (2010) and Du et al (2014), studied the automotive and technological industries, proving the advantages of Open Innovation.

Chiaroni et al (2010) established two dimensions of Open Innovation: Inbound and Outbound. Inbound is defined as the search for relationships with external organizations to access competencies and knowledge. This model can be operationalized through partnerships, acquisition of licenses of use or even of the company that hold them. The second dimension is Outbound Open Innovation, whose purpose is to establish relationships with external entities to commercialize the company's expertise in the form of patents, management models, etc. Gassmann & Enkel (2004) add a third dimension that combines the first two with the same external organization, that is, a company involves an external partner in the innovation of a product while licenses for the partner the use of a patent. Customers, competitors and suppliers are the most common cases. This dimension was widely used in the automotive sector by reciprocal licensing agreements (Lli et al, 2010).

A study conducted in 203 R&D Labs of Japanese companies showed that Open Innovation increased the overall performance of Laboratories. The interaction with universities increased the performance of Laboratories in research and the collaboration with companies increased the performance in development (Asakawa et al, 2010). In Austria, a study showed that the interaction between industry-university contributes to the industrial innovation, providing not only new types of technology but also a variety of other forms of exchange of knowledge, including, for example, direct interaction between employees and researchers, the execution of research and consulting contracts, the collaborative development for research, the company's financing for the university, the training of employees by the university, publications and academic papers (Chartinger et al, 2002).

New government programs and some changes in legislation have contributed to the growth of research studies developed in partnership between companies and universities. There is a certain pressure for universities to contribute more effectively to the competitiveness of local companies, in addition to the expected generation of new knowledge and academic publications (Greenaway & Haynes, 2000, Perkmann & Walsh, 2007).

Studies conducted by Adams et al. (2001), Bruneel, et al. (2010) and Chaves et al. (2012) showed that the areas in which the companies most frequently seek partnerships for promoting joint innovation with universities are: pharmaceutical, engineering, steel, chemical and aerospace. Bekkers & Freitas (2008) state that the collaboration with the university is more common in sectors where the technology requires a rapid development, since the companies have shorter product cycles and operate in markets with many bidders.

The company-university relationship can be beneficial for the company, as it starts having easier access to emerging technologies, important inputs for the development of new

products and processes and can have privileged access to the knowledge of the university, to the most outstanding students and specialized researchers. Universities can benefit from the generation of patents, academic publications, the opportunity to apply knowledge by the students, new sources of financing for projects and the opportunity to develop new products and processes (Feller, 2005, Perkmann & Walsh, 2007). However, the company-university relationship may pose risks depending on the different interests of the company and the university in relation to the jointly developed project, such as: information security, failure to keep the confidentiality of the projects, different views on the role of bureaucracy, different speeds of operation, etc.

The basic principle of open innovation in a company is the existence of interaction with external agents for the shared use of knowledge and resources (Dahlander & Gann, 2010). Open innovation may occur through various forms of interaction, and at different frequencies. The exchange of knowledge between partners may not be as simple as idealized. The knowledge generated in partnership needs to be incorporated by the staff of both institutions, but the codification and transfer of this knowledge does not always occur effectively, which leads some companies to opt for in-house development (Vega & Vanhaverbeke, 2010).

Partnerships between companies and universities require some adaptations in order to establish a successful relationship. Miotti & Sachwald (2003) state that the choice of a partner should consider the objectives that the company is looking for, whether in relation to the type of innovation, cost, among others, and then identify the partners that have the necessary additional resources. In general, the company and the university have different objectives and cultures, which may create conflicts of interest during the implementation of the project. In addition, it should be taken into account that the delivery by the university may not fully meet the company's expectations, either due to communication gaps, problems in the relationship between the stakeholders (Veugelers & Cassiman, 2005), or because the company has not fully developed a capacity of absorption of the technology (Chaves et al, 2012; Cohen & Levinthal, 1990; Scharinger et al, 2002). For example, previous research explained the benefits of open innovation i.e. time to market, sales, intra-technology transfers, patents, novelty (Du et al., 2014; Piezunka and Dahlander, 2015) as well as the role of different search mechanisms i.e. platforms, intermediaries, consultants, crowdsourcing (Afuah & Tucci, 2012; Lopez-Vega et al., 2016). While these previous studies present the outcomes and the mediation variables of open innovation projects, very little is known about the antecedents of these projects. For example, management expectations about external knowledge integration or matching could affect the decision to conduct an open innovation project (Bengtsson et al., 2016; Salter et al., 2014; Zobel & Chesbrough, 2015). Also, the radicalness of projects might affect the decision to open or close an innovation project by project managers. Moreover, while numerous research has explored open innovation at different levels i.e. country, firm, unit and user levels (Chesbrough et al. 2011; Di Minin et al. 2010; Dahlander & Piezunka, 2014). To our knowledge, only the study from Du et al. (2014) has focused open innovation at the project level. Until now, research has not investigated the factors influencing on managerial decisions to conduct an open or closed innovation project.

Therefore, the company's decision to follow an open innovation strategy with universities requires a careful analysis of the possible restrictive factors involved. Moreover, it is also necessary to decide which level of openness is more adequate to the interests of the

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company. This level of openness may vary between the various Business Units of the company, among the various innovation projects of the same Business Unit and may also vary depending on the phase of a given project.

The purpose of this paper is to propose a set of factors to help corporate managers decide on the adoption or not of an open innovation strategy with a university to one or more stages of an innovation project. The results contributed to address The Following questions: (i) Which factors contribute to help managers decide which innovation projects or which parts of the innovation projects should be carried out internally and which should be carried out by a University? (ii) Which factors are more relevant to support this decision? Although the literature on open innovation is abundant, studies on factors to decide on the degree of openness in the process of Open Innovation are scarce. To contribute to the development of Open Innovation, we conducted a study at Natura, a Brazilian company with multinational presence, a leader in the Brazilian market with 44% share in the hygiene, perfumery and cosmetics segment. Natura has extensive experience in open innovation, adopted by more than half of the innovation projects. A conceptual model was outlined based on the literature and tested with the company's managers who interact directly with universities for the development of innovations in products and processes.

The findings contribute to the literature available on the relationship between the company and the university, identifying and testing a set of factors that proved to be useful to assist the management decisions on the adoption or not of open innovation for one or more phases of a innovation project.

2 Conceptual Model

Table 1 below summarizes the factors mentioned in the literature to support the decision making of managers regarding the promotion or not of open innovation with universities. These factors were grouped into five dimensions, considering the similarity between them: Speed for the result to be delivered by the university, quality and chance of success of the project conducted by the university, intellectual property of part of the project developed by the university, absorption of knowledge by the company, and amount charged by the university to develop the part of the project contracted by the company.

Table 1. Relevant factors in the decision making on open innovation between companies and universities

Dimensions	Factors	References
SPEED for the result to be delivered by the university	The deadline proposed by the university is in line with the company's needs	Miotti, L. and Sachwald, F. (2003); Veugelers & Cassiman (2005); Lacetera, N. (2009).

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Dimensions	Factors	References
QUALITY AND CHANCE OF SUCCESS of the part of the innovation project conducted by the University	The quality of the university's equipment and laboratories in the field related to the contract is higher than that of the company	Chaves, C., Carvalho, S., Silva, L., Teixeira, T. & Bernardes, P. (2012); Muscio, A., Quaglione, D. & Scarpinato, M. (2012); Adams, J., Chiang, E. & Starkey, K. (2001).
	The knowledge and qualifications of the university staff in the field related to the contract are superior in relation to the company, increasing the quality and the chances of success	Schartinger, D., Schartinger, D., Rammera, C., Fischer, M. & Fröhlich, J. (2002); Chaves, C., Carvalho, S., Silva, L., Teixeira, T. & Bernardes, P. (2012); Veugelers, R. & Cassiman, B. (2005); Lacetera, N. (2009); Bekkers, R. & Freitas, I. (2008); Bloedon, R. & Stokes, D. (1994).
	The previous experiences of the company with the university staff were successful	Perkmann, M. & Walsh, K. (2007).
	There is a high recognition of the university on the market in the field related to the contract	Adams, J., Chiang, E. & Starkey, K. (2001); Bloedon, R. & Stokes, D. (1994).
	The university offers agile processes to execute and implement the project.	
	The part of the project developed by the university is easy to integrate to the other parts of the innovation project	Veugelers, R. & Cassiman, B. (2005); Lacetera, N. (2009).
INTELLECTUAL PROPERTY regarding the part of the project developed by the university	The university agrees to respect the aspects that require confidentiality and in return the company supports the publications of the others	Bloedon, R. & Stokes, D. (1994); Chaves, C., Carvalho, S., Silva, L., Teixeira, T. & Bernardes, P. (2012); Veugelers, R. & Cassiman, B. (2005); Perkmann, M. & Walsh, K. (2007); Bekkers, R. & Freitas, I. (2008);.
	The part of the project conducted by the university is still in the pre-competitive stage	Chaves, C., Carvalho, S., Silva, L., Teixeira, T. & Bernardes, P. (2012); Veugelers, R. & Cassiman, B. (2005); Bekkers, R. & Freitas, I. (2008); Bloedon, R. & Stokes, D. (1994).
	The part of the project contracted with the university is not strategic to the company's competitiveness	Laursen, K. & Salter, A. (2004), Lacetera, N. (2009), Bekkers, R. & Freitas, I. (2008); Veugelers, R. & Cassiman, B. (2005).
	The university accepts the patent ownership proposal made by the company	Bekkers, R. & Freitas, I. (2008); Miotti, L. and Sachwald, F. (2003); Veugelers, R. & Cassiman, B. (2005);
KNOWLEDGE ABSORPTION BY THE COMPANY	There is a high possibility for the company to learn with the university staff	Schartinger, D., Schartinger, D., Rammera, C., Fischer, M. & Fröhlich, J. (2002); Veugelers, R. & Cassiman, B. (2005); Keld Laursen, K. & Salter, A. (2004); Chaves, C., Carvalho, S., Silva, L., Teixeira, T. & Bernardes, P. (2012), Lacetera, N. (2009); Perkmann, M. & Walsh, K. (2007); Lane, P. & Lubatkin, M. (1998).
	The university accepts clauses that favor the absorption of technology by the company.	Cohen & Levinthal (1990); Schartinger, D., Rammera, C., Fischer, M. & Fröhlich, J. Knowledge (2002); Veugelers, R. & Cassiman, B. (2005) Chaves, C., Carvalho, S., Silva, L., Teixeira, T. & Bernardes, P. (2012), Lane, P. & Lubatkin, M. (1998); Bloedon, R. & Stokes, D. (1994).

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Dimensions	Factors	References
AMOUNT CHARGED BY THE UNIVERSITY TO DEVELOP THE PART OF THE PROJECT CONTRACTED BY THE COMPANY	The cost is lower if contracted with the university when compared to the company's cost	Miotti, L. and Sachwald, F. (2003), Chaves, C., Carvalho, S., Silva, L., Teixeira, T. & Bernardes, P. (2012), Muscio, A., Quaglione, D. & Scarpinato, M. (2012); Veugelers, R. & Cassiman, B. (2005); Adams, J., Chiang, E. & Starkey, K. (2001), Bloedon, R. & Stokes, D. (1994).
	Partnering with the university facilitates government funding for the company	Lacetera, N. (2009); Miotti, L. and Sachwald, F. (2003); Veugelers, R. & Cassiman, B. (2005); Perkmann, M. & Walsh, K. (2007), Bloedon, R. & Stokes, D. (1994).

Since open innovation has advantages and disadvantages, it is not always the best solution for the development of innovations. This topic aims to identify, through literature review and field research, a number of factors to help the manager decide, given a particular innovation project, if any part of this project should or should not be conducted by a University.

Among the factors to be considered in the decision of whether to adopt Open Innovation, project **speed** has stood out in the literature and in the practice of companies as a very important element, especially in firms that rely on the rapid development of technologies, such as biotechnology, information technology and new materials (Veugelers & Cassiman, 2005). Many companies that invest in research and development (R&D) have expanded their business to the global level and thus have sought to develop new competencies or develop partnerships in order to accelerate the development of new products and processes (Miotti & Sachwald, 2003). In the company-university relationship, the duration of a research project does not always meet the business requirements primarily dictated by the market. Researchers, in turn, are motivated and demanded to produce high quality science, which would increase the potential for economic success of the innovation. However, the objectives of those involved in the partnership may change over time.

One of the reasons that lead companies to establish partnerships with universities is the **infrastructure of the university in terms of equipment and laboratories**. The research conducted by Chaves et al (2012) showed that approximately 63% of the managers of the companies interviewed classified the existence of laboratories at the university as of strategic importance at least moderate for the company. University laboratories tend to be larger and more structured than those existing in the research centers of the companies. Adams et al (2001) found evidence that the laboratory size and academic excellence drive the generation of patents and investment in research.

At the universities, companies also find the **expert knowledge of researchers**. Veugelers & Cassiman (2005) explain that the companies envision alliances as a learning experience and only gradually build a lasting commitment. Factors such as the importance of establishing direct relationships (face to face communication) to strengthen corporate capital, trust, common research language and culture may facilitate the company's access to university knowledge were also mentioned by Schartinger et al (2002). The consolidation of the corporate capital occurs through personal interactions between the actors.

Chaves et al (2012) argue that the generation of technological knowledge is essential for technological progress. Despite the fact that this activity does not take place exclusively at the university, having access to the cutting-edge knowledge produced by a university that is a center of excellence in a particular area of knowledge is a privilege and a facilitator for the

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acquisition of advanced scientific knowledge by the company. This relationship also helps the company's scientists and engineers to have insights that are likely to become innovative products and processes. The interaction between the company and a university allows an efficient use of academic knowledge in view of the needs of the company and its markets. Companies basically use two strategies in relation to this cooperation. One strategy consists of the adoption and early application of the academic knowledge already developed by the university and the other, which is the focus of this study, consists of the decision to develop parts of the project in partnership with universities. In both cases, the companies seek in the universities researchers who have specific expertise. For this, the companies use as one of the criteria the level of **qualification of university staff, taking as an indicator** the number of publications of the researchers (Bekkers & Freitas, 2008, Lacetera, 2009).

Even if the company chooses to establish a partnership for the acquisition of knowledge developed by the university rather than developing in-house, the academic researcher and their history have relevance in the choice of the university (Bloedon & Stokes, 1994). The reputation of the academic researcher may have a significant contribution to the **recognition of the university on the market**. Academic studies generate publications and patents and these achievements contribute to the reputation of the university. However, this fact may cause conflicts with companies that often value the **confidentiality of information** (Adams, Chiang & Starkey, 2001).

In addition to the researchers' qualification and the university's reputation, previous experiences of the company in works performed jointly with universities is a relevant factor in the company's decision to establish new partnerships and also help choosing the university. Overall, the relationships established with universities are formalized, but it is common that these relationships have been motivated by interpersonal relationships of informal nature. In other cases, the experience of conducting formal works collaboratively makes the individuals involved from the company and university to develop relationships of affinity that motivate the establishment of partnerships in the future (Perkmann & Walsh, 2007). In short, the **successful experiences of the company** facilitate and encourage new relationships with the same university and indirectly facilitate relationships with other universities.

A criticism that the companies have made to universities refers to the **existence of slow processes for the formalization of partnership and implementation of the project**. In Brazil, the companies interface with universities in several ways: through foundations created by professors, by the university itself, direct contact with professors or contacts with the Technological Innovation Centers of universities.

The collaborative development of a project does not depend on the formalization of the agreement in order to be successful. The company needs to bring together the human and material conditions to receive this knowledge and absorb it so that the **part developed by the university may in fact be integrated with other parts of the project developed by the company**. This requires that companies have some basic research structure and keep focused on what was requested by the university, given that constant changes in the project scope may jeopardize the value of the delivery by the university (Veugelers & Cassiman, 2005; Lacetera, 2009).

A survey conducted in Europe showed that companies that agree with the academic publications by the partner universities develop more collaborative and mutually beneficial

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relationships (Perkmann & Walsh, 2007). According to Veugelers & Cassiman (2005), from the company's perspective, the disclosure of information may jeopardize its marketing strategy and reduce the competitive potential of the innovation to be developed. The solution found by the companies was to include **confidentiality** clauses in the contract, which limit what may or may not be disclosed. The possibility of information leakage is something that the companies deem relevant in their decision of whether or not to adopt open innovation with universities.

Perkmann & Schildt (2015) report that some companies that invest in intensive research have been making experiences with initiatives that work with open data, which involves the collaboration of academic scientists, who publish the results without any restriction. However, the companies seeking to benefit from open data face two main challenges: having to deal with the leakage of strategic information to competitors and the demotivation of academic scientists in discussing the problems posed by the companies.

The company's concern with the disclosure of information may also be related to the stage in which part of the project agreed currently is. In order to protect their project, some companies choose to establish collaborative relationships for the development of part of the project (Bekkers & Freitas, 2008), especially in the **pre-competitive phase**, that is, in the early stage of technological development. It should be noted that at this stage, the financial barriers to innovation may be strong, given the high technological and market uncertainty (Veugelers & Cassiman, 2005). Throughout the project, the relationships tend to intensify, the companies start seeing in this collaboration the opportunity to be in touch with a wider network of information and this stimulates the common interest in further maintaining the research (Chaves et al, 2012). According to Bloedon and Stokes (1994), the companies are aware of the importance of collaborative research, regardless of the stage, as a way to expand their core competencies and even in the decision on how to use their R&D resources in order to maintain their competitive advantage.

Whenever possible, the companies prefer to conduct **parts of the project deemed non-strategic** externally, but this model is not always feasible. The studies conducted by Veugelers & Cassiman (2005) and Bekkers & Freitas (2008) suggest that the complementary relationship between company and university has positive effects. Therefore, it can be said that the part of the project to be developed by the university may also be a strategic step for the company. Laursen & Salter (2004) explain that companies tend to overestimate the universities as sources of knowledge for innovation. There are companies that choose to develop research studies in strategic areas in-house and others that prefer to negotiate stronger controlling rights, especially when the collaboration involves long-term projects.

As already mentioned, patents and publications are strategic objectives of the university. Bekkers and Freitas (2008) point out that the number of patents is one of the criteria considered by the companies when choosing the partner universities. Finding a university that accepts the **company's proposal on a possible patent** (shared or not with the university) is equally one of the important criteria. Studies on patent strategies emphasize the need for companies to own high quality technological resources in order to build a portfolio of strong patents (Miotti & Sachwald, 2003). However, requiring that the parties involved comply with the cooperation agreement becomes more difficult when the technology is surrounded by uncertainty and even more when they include the issues of intellectual property rights, since neither party can, in fact, determine the limits of these rights, as it involves a joint

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development and in some cases, it may stand as an insurmountable barrier (Veugelers & Cassiman, 2005).

As a reason for adopting open innovation the literature presents the **possibility of companies to learn from universities**. The collaboration allows the company's access to specialized know-how, but also requires a reciprocal relationship with the university, a relationship that strengthens mutual trust and reduces uncertainty about the ownership of the outcome of the project (Schartinger et al, 2002; Veugelers & Cassiman, 2005; Perkmann & Walsh, 2007). The interactions are characterized by the degree of formalization, the ability to carry out the transfer of tacit knowledge and the intensity of personal contacts. The latter may occur through activities such as speaking, listening, demonstrating or emulating behaviors. The new knowledge is often a new combination of existing elements and even though a considerable part of the research is conducted in the universities, the companies need a team of internal researchers to absorb the knowledge generated (Schartinger et al, 2002; Chaves et al 2012; Lacetera, 2009). Petruta et al (2004) suggest that companies that adopt the open innovation strategy are usually the companies that have already made investments in R&D and are more likely to promote collaboration with universities.

Lane and Lubatkin (1998) identified three methods to acquire external knowledge: passive, active and interactive. Passive learning appears when firms acquire articulated knowledge (observable) on technical and management processes from sources such as magazines, seminars and consultants. Active learning involves market and competitors intelligence that can provide a broader view of the capabilities of other companies. Passive and active knowledge are absorbed primarily by observation. These learnings have a limited contribution to the development of new competencies. They are not rare, difficult or complex to be imitated. They can be transferred as "recipes" to the industries. The interactive knowledge results in greater value for those involved. Thus, students and teachers can approach the company enough to understand the observable elements and also the tacit components, that is, the "how and why". The exchange of knowledge in the company-university relationship is important, but the company needs to not only exchange knowledge but also be able to absorb the new technology, that is, it is expected that the company has the ability to value, assimilate and use the new external knowledge (Lane & Lubatkin, 1998).

The ability to evaluate and use the external knowledge is related to the level of knowledge required. At the most basic level, this prior knowledge includes basic competencies, but at a higher level, it may include mastering the latest scientific and technological developments in a given field. A key aspect in this process is the company's ability to recognize the value of new information, assimilate and apply them to commercial purposes (Cohen & Levinthal, 1990). The potential economic value of the new product modulates the way in which the exchange of knowledge occurs between the actors, creating the need to establish rules of confidentiality and a relationship of trust to enable the exclusive appropriation of knowledge (Schartinger et al, 2002). It should be noted that in order to absorb knowledge, the companies need to have basic and applied skills of R&D. This is achieved through the use of proper R&D inputs, as well as through outsourcing (Veugelers & Cassiman, 2005).

Another factor considered in the company's motivation to develop part of the new product with the university is the issue of investment **cost** in R&D. At first, this relationship allows companies to reduce the demand for investment. From a resource-based perspective,

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companies will conduct joint research projects with universities to the extent that they are expensive, risky or complex. Companies that perform this cooperation tend to focus on high-tech sectors or emerging industries and this arrangement allows expanding their sources of knowledge and capacity of achievement, even with investment restrictions (Miotti & Sachwald, 2003, Veugelers & Cassiman, 2005).

The reduced demand for investment by the company may also be related to government incentives. The establishment of partnerships with universities may **help the company to obtain governmental financing** for the research. Lacetera (2009) states that, in light of these public funds, the investment made by companies remains virtually at the same level and the public funding is significant for academic studies that *a priori* have no economic purposes. Perkamann and Walsh (2007) report that in Europe the programs promoted by the European Commission provide funds for collaborative projects involving universities and companies. In the US they have the Advanced Technology Program (ATP) and in the UK there are several programs funded by the National Health Service. The question raised by the authors is whether public funding would only be replacing the industry's investments in R&D or if the research conducted would, in fact, complement the investment in R&D that companies have made for the development of new products and services. There is evidence that public support stimulates the development of R&D and the commercialization of innovation.

3 Methodology

Given the objective proposed, we opted for a qualitative approach to data collection, suitable for the study of strategic processes, which allows capturing the phenomenon in great detail (Langley & Abdallah, 2011). Initially, we conducted a literature review on the subject and outlined the conceptual model. Next, the data collection consisted of a focus group to review the conceptual model and subsequently analyze it in the context of a company. The focus group method allows us to analyze the content and the interactions between the members of a group during the discussion of a subject (Överlien et al, 2005), in this case, open innovation.

The focus group was conducted in three stages: Initially, we asked the group what are the relevant factors in the decision to promote open innovation, the list prepared based on the theoretical framework was presented to the group so that it proposed complements, corrections or exclusions, and finally, we closed the discussion. The focus group relied on the participation of professionals from eight companies related to innovation: Embraer, Natura, 3M, Samsung, Cristália, Braskem, Accenture and Motorola, lasting 45 minutes and the discussion was recorded. This methodology improved the conceptual framework in several ways. One of the contributions was to realize that the form of writing the factors could be improved. For example, "quality of the University's equipment" was changed to "quality of the University's equipment in the field related to the contract." Another result was a preliminary identification of priority aspects to be further discussed in the interviews, such as the issue of confidentiality required by the company and the need for the University to publish. The discussions between members of companies from different sectors has shown the importance to, in future studies, compare companies from different sectors and use quantitative methods. These aspects were included among the suggestions for future studies.

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The second stage of data collection consisted of four in-depth interviews seeking to analyze the decision on open innovation within a company. The respondents were asked to comment on fifteen factors and their applicability to the reality of Natura and they were asked to choose the four most important factors. The interview in semi-structured format (Fontana & Frey, 1994) used the script written based on the literature review and on the results of the focus group. Much additional information was obtained by one of the authors of this paper who has been a senior executive of Natura for more than ten years and spent large part of her career dealing with open innovation. Natura was chosen because it is a leading company in the field of innovation, as shown in the following topic. Given the focus of the research, we interviewed four managers of the company with extensive experience in practicing open innovation with Universities. The interviews were conducted in December 2015 and January 2016, with an average duration of 45 minutes each, utilizing a pre tested outline based on the conceptual model.

4 About Natura

Natura Cosmetics is a Brazilian company founded in 1969, leader in its market segment (hygiene, perfumery and cosmetics) with a strong presence in Latin America. It primarily uses the direct sales model, with 1.7 million sellers (called Natura Consultants), reaching nearly 100 million consumers with its products. Its value chain includes more than 5000 suppliers and third parties (companies that manufacture products on behalf of Natura) and 33 agro-extractivist communities. Innovation is one of its main pillars of competitive advantage, focused on growth, differentiation and sustainable development. In 2006, Natura made the strategic choice to act in open innovation along its value chain to develop new technologies and methodologies to incorporate into its products and services as well as increase its productivity in the development of its products, having even created an area for its formal implementation, although partnerships have been established since the early 2000s.

The open innovation model of Natura was one of the first to be developed in Brazil, having served as a reference for the different players of the national innovation ecosystem. It currently includes the Natura Campus program, created in 2006 to capture opportunities for projects and establish relationships with the academia for science, technology and innovation; the program *Cocreating Natura* focuses on innovation in collaboration with end-users engaged with the company's mission. Natura has another program for the development of suppliers and partners for innovation. It includes suppliers of productive and non-productive inputs, including services, such as research and measurement institutes, NGOs, as well as science and technology institutions (universities, research institutes). All partners who carry out innovation projects with Natura have their performance evaluated by the R&D and Consumer Safety teams, both in operational dimensions within the projects, as well as their contribution to the relevance of the result. This evaluation is consolidated for a periodic public recognition by all partners, and everyone individually receives a feedback, so that they have the opportunity to discuss opportunities for joint improvements. In this report, in the case of productive suppliers, they also have the opportunity to understand their performance in comparison with their direct competitors, to understand their position of preference for new opportunities. In addition, there are rules and policies to determine how the different interactions are established with different partners.

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More than 50% of the innovation projects conducted by Natura are developed through the open innovation model, which has evolved in recent years to a presence in network, where the interactions are not restricted to projects, but to other opportunities to generate value. Natura's network of formal partners, that is, those who already have partnership agreements, includes more than 200 institutions.

5 Analysis

The dimensions and factors outlined in the conceptual model were applied to Natura. The dimensions and factors were in line with the literature, but some of them were more relevant than others. Next, we will discuss each one of the dimensions and their respective factors. The four respondents were asked to discuss each one of the 15 decision factors that of the conceptual model in terms of their applicability to the Natura case. In addition, they were asked to point out the four most important factors when deciding to adopt open innovation, by partnering with a University to conduct part of an innovation project. The result is shown in Table 2.

Table 2 - Most important factors according to the respondents

FACTORS THAT INFLUENCE THE DECISION ON OPEN INNOVATION	FREQUENCY OF CHOICE
The previous experiences with the university staff were successful	4
The knowledge and qualifications of the university staff in the field related to the contract	4
The deadline proposed by the university is in line with the company's needs	3
The university accepts the patent ownership proposal made by the company	2
The university offers agile processes to execute and implement the project.	1
There is a high possibility for the company to learn with the university staff	1
Recognition of the University on the market in the field related to the contract	1

The factors related to each one of the dimensions will be analyzed below.

5.1 Speed

The dimension speed involves the negotiation time with the university from the initial contact to the execution of the contract plus the period established in the contract for the university to deliver its part of the project. This dimension has only one factor: **speed**. This factor was considered by all respondents as one of the four most important. The importance of this factor is in line with the results of the study conducted by Veugelers & Cassiman (2005). The respondents mentioned that the University does not give much importance to this factor, which often leads to misunderstandings, as pointed out by Miotti and Sachwald

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(2003). At Natura, the deadlines are negotiated to meet the expectations of both parties, as proposed by Lacetera (2009). Still, some of the company's projects are not conducted jointly with the university when the deadline estimated by the university does not meet the business demand of the company. This is because besides the university's deadline, there are other deadlines involved for the result of the research to be incorporated into the project and tested. One of the respondents said that: "the university's reputation in meeting the deadlines in previous projects is a relevant factor for the company to establish new contracts."

5.2 Quality and Chance of Success

This dimension includes six factors: quality of university's equipment and laboratories, knowledge and qualification of researchers, recognition of the university in the market, experience with open innovation, agile processes to execute and implement projects and easy integration of the project delivered by the university into the innovation project.

The factor **knowledge and qualifications of the university staff** was reported by all respondents among the four most relevant. The acquisition of academic knowledge by the company was identified as a strong motivator of the company's decision to adopt open innovation. As widely mentioned in the literature (Veugelers and Cassiman, 2005); Bekkers & Freitas, 2008; Lacetera, 2009; Chaves et al, 2012) the company finds expert knowledge in the university. According to one of the respondents:

"The discovery of researchers who are experts in certain areas occurs naturally. The company's staff and university researchers meet at conferences, workshops and other events, in addition to the access to the publications of the researchers. This is not done in a systematic way by the company."

This finding corroborates the statement of Schartinger et al (2002) that there is a need to establish direct relationships (face to face communication) to strengthen the corporate capital, trust, a common language and culture of joint research may facilitate the access of company to the academic knowledge. The proposition of Bloedon and Stokes (1994) that the researcher's background is relevant when choosing the university was confirmed. Another factor highlighted was the **previous successful experiences with the university staff**. This was unanimously mentioned by the respondents as one of the four most important factors. There was also a clear trend that the company forms partnerships with universities with history of successful experiences. The following statement illustrates this fact:

"...first we talked with to Technological Innovation Center of the university to identify what are the steps involved to develop the contract and then the project, and after that try to understand what are the real problems. In parallel, we looked at the history of the university within Natura itself, talking to the staff who have worked with this university at other projects and find out how the experience was."

It should also be taken into account that there is also a personal interaction between the company's staff and the university researchers. There are cases in the company in which the researcher brought such a significant and positive experience to the company that the

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partnership was formed with the individual, regardless of which university will work with the company in the future. This may influence the choice of the university by the company, which confirms the statement of Schartinger et al (2002) on the need to develop personal relationships.

The **recognition of the university on the market in the field related to the contract** was chosen among the four most relevant factors by only one of the respondents. The universities that are not well-known or those with which Natura has not yet partnered require further investigation by the company as a way to assess the possible risks. Some respondents have reported that: “The university’s reputation is important as a starting point, but in the case of public universities, to avoid difficulties of legal nature, they select those with prior approval by the Government for the establishment of partnerships with companies.”

This procedure avoids both problems during the negotiation and possible delays caused by the lack of clear guidelines established by the university.

It was identified that Natura privileges universities that have agile processes to both **establish and implement the project** – this factor has become increasingly important in the opinion of one of the respondents (the only one who included it among the four most significant factors). According to him: “This was not a factor that, in the past, we considered very important. It was seen as a sub-factor of interaction, but we have been increasingly learning from our experiences and today it is much more significant than in the past.”

The company establishes *a priori* a deadline for the execution of the contract, and if this term is not fulfilled the project is abandoned at this stage. Natura also establishes a maximum time horizon for the delivery of the project contracted with the university. The company considers this factor a precondition to contract the university. The agreement takes place mainly through the Technological Innovation Centers of the university.

With regard to the factor **quality of equipment and laboratories**, one of the respondents explained that: “Our researchers in the R&D area have contacts in the academia and they emphasize the importance of the equipment quality for the success of the technological development.”

As suggested by Veugelers and Cassiman (2005) and Lacetera (2009), the company must have a minimum research structure and seek at the university a complement of its competencies. Natura has mapped its partners, so that in case it needs a specific equipment, it knows in which universities it can be found, and also which researchers work at the institution and are able to facilitate the establishment of an agreement. When the university does not have equipment, but the professor is a reference in the area, Natura considers the possibility of buying the equipment and the professor develops the project, using the company’s equipment. Also, it was reported in the interview that in the relationship the universities receive material compensations provided by the company in the form of payment and equipment. In one of the interviews, it was mentioned that the company doesn’t always have all the necessary equipment and also cases in which the universities have not accepted to use the company’s equipment for the development of the research. In that case, they requested Natura to buy and donate the equipment to the institutions.

The factor **the part contracted with the University can be easily integrated into the other parts of the innovation project** was deemed relevant because partnering with a University to conduct part of the project that is difficult to integrate with other components can be a very complex process. However, if the company does not have the necessary

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competence, it is necessary to obtain this knowledge outside. This adaptation will be easier when there is a more frequent interaction between the company's staff responsible for the innovation and the university staff. It was identified that Natura's researchers interact with the university researchers and conduct workshops to share information. The transfer of knowledge also occurs through technical reports. The interviews showed that if the company clearly defines what should be developed and select the appropriate university, the company can more easily integrate the part delivered by the university. The fact that Natura also has researchers with high-level technical knowledge facilitates the integration of the contribution of the university to the innovation project.

5.3 Intellectual Property

This dimension consists of four factors: confidentiality, contracted phase is in the pre-competitive stage, contracted phase is not strategic and acceptance by the university of the patent ownership proposal made by the company. In the case of Natura, the issue of **acceptance by the university in relation to aspects that require confidentiality** is pre-defined through a confidentiality agreement. On the other hand, Natura allows academic publications by the university that do not adversely affect confidential aspects deemed relevant to the company and this is explained in the contract. The concern with confidentiality in the university-industry relationships was reported by Veugelers and Cassiman (2005) and Perkmann and Schildt (2015). This factor was considered relevant because it helps the company to protect the value of the innovation it intends to develop, but it is a less important factor than the deadline, the qualification of researchers and the agility in the processes and implementation of projects. However, the respondents reported cases in which the researchers have published information on ongoing research without authorization. This is more common in final dissertations, in which the researchers conclude their graduation presenting master or PhD dissertations and leave the project.

It was found that at Natura **the part of the project developed by the University is usually in the pre-competitive phase**. This does not mean, however, that the company does not establish partnerships with universities to other phases of the project. This behavior confirms the statement of Bloedon and Stokes (1994) that companies perceive the importance of collaborative research, regardless of the stage. The preference of the company for the pre-competitive stage, according to the researchers, is related to the fact that the company does not always have the expertise to develop a particular molecule or component, for example. This requires time and investment. It was also mentioned that, at this stage, the issue of confidentiality is less sensitive for the company, since it does not involve a product yet but rather a part of what could become a product. This is consistent with the statements of Bekkers and Freitas (2008).

The respondents expressed some doubts about the factor 'the **contracted phase is not strategic for the university**'. One respondent explained that: "This is an important factor, just as the entire mobilization of the company in order to procure and develop the components or technology demonstrates that the work of the university is part of the strategic objective of the company." Another respondent said that: "In certain occasions the university's role may be more or less relevant to the company's strategy."

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Another respondent pointed out that: “It is not possible to separate one part from the other, since the success of the innovation depends on the set of information, decisions and actions.”

All respondents agreed that the company seeks to keep the university informed about its corporate strategy. It is worth noting that Veugelers & Cassiman (2005) and Bekkers & Freitas (2008) state that the exchange of knowledge between the company and the university has a positive effect for the industry. One of the four most important factors was that **the university accepts the possible patent ownership proposal made by the company**. Natura includes this component in the contracts executed with Universities. The company has a standard contract, but it may undergo adjustments if necessary. The studies conducted by Veugelers & Cassiman (2005), Bekkers & Freitas (2008) and Miotti & Sachwald (2003) emphasize and confirm the potential conflicts regarding the ownership of patents in the university-industry relationships. According to one of the respondents: “Natura is favorable to patent sharing with the university”

This same respondent said that a recent partnership resulted in the development of a technology for the development of an anti-age product line. As a result, the patent right was shared with the university and the company pays a certain amount for every new product of the same line that uses the component developed by the partnership. The acceptance of the patent ownership proposal by the university is among the most relevant factors for establishing the partnership. Another respondent said that Natura has no problems with patents due to its practice of clearly establishing the parameters prior to the beginning of the project.

5.4 Knowledge Absorption by the Company

This dimension includes two factors: possibility to learn with the university staff and the acceptance, by the university, of clauses that favor the absorption of technology by the company. The respondents stated that the **possibility to learn with the university staff** is an important factor, because it contributes for the company to have access to specialized know-how. This factor was selected by one of the respondents to make up the list of the four most important factors. This is in line with the studies of Schartinger et al (2002), Veugelers & Cassiman (2005) and Perkmann & Walsh (2007). It is easier to learn with the university when the company researchers participate in the study and interact with the university team. Lacetera (2009) states that some companies encourage their researchers to participate in activities in the academic community and this contributes to the accomplishment of changes, especially in understanding the university’s perspective.

The interviews showed that the company actively seeks knowledge in scientific areas that it has not mastered yet. Therefore, the company chooses to partner with universities to fulfill its specific technology needs, that is, it establishes partnerships for the development of strategically predetermined components. One of the respondents said that: “Natura does not have the motivation to develop a joint project with the sole intention to learn from the university, but to develop a technology that is strategic to it.”

It was mentioned that it is relevant to include clauses in the contract to ensure the absorption of technology by the company, however, it is up to the company to invest in its human resources to enable them to absorb the knowledge that has been produced. Veugelers

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& Cassiman (2005) and Lacetera (2009) state that a successful relationship between company and university also depends on the company's condition to receive the knowledge and absorb it so that the part developed by the university may in fact be integrated into the other parts of the project. Natura considers this an important factor, however, it does not represent a barrier for the company to establish or not open innovation with universities.

As for the factor '**the university accepts clauses that favor the absorption of technology by the company**', it was found that Natura includes this type of clauses in their standard contract. The respondents mentioned that since the part contracted with the university is specific, the absorption of technology by the company becomes easier. One respondent stated: "Natura already has a robust R&D structure and the company's researchers work closely with the university researchers and thus, the absorption of technology occurs naturally."

It was also mentioned in the interviews that the approval of a new law on innovation has made it possible to negotiate the transfer of technology, by the public university, exclusively to a particular company, whereas previously this was only possible through the bidding process, which was much more complex. It is worth noting the importance of the company to develop the technology absorption capacity (consistent with the statements of Cohen and Levinthal, 1990 and Lane and Lubatkin, 1998) and have a minimum R&D structure, according to the recommendations of Veugelers and Cassiman (2005) and Chaves et al, (2012).

5.5 Cost

The dimension 'cost' includes two factors: the cost is lower if the university is contracted and partnering with the university facilitates the access to government funding. It found that a **lower cost** was not among the most important factors for the decision to establish partnerships with universities. The respondents explained that the product obtained in the relationship with the university can not always be obtained otherwise. The respondents mentioned that, in general, the costs of Natura's projects in partnership with universities are appropriate with the value delivered. The respondents recognized that, overall, the cost of partnering with universities is still lower than entering into a contract or partnership with a private company.

The respondents confirmed that the company seeks and uses government funds to stimulate research, confirming that **partnering with universities facilitates the access to government funding**. One respondent explained that: "Incentive is one of the items considered in the decision, but there are others (university competencies and group of specialized researchers, among others), which contribute to the decision of contracting the university."

It can be seen that, in fact, the partnership with the university enables government fund-raising for innovation, thus contributing to innovation in the company. Therefore, it was possible to confirm the statements of Perkamann and Walsh (2007) and Lacetera (2009) that government incentives influence the promotion of innovation in the companies.

The factors proposed in this study and that were considered most relevant to the company's decision to adopt an open innovation strategy with universities were: (i) deadline proposed by the university in line with the company's needs, (ii) knowledge and qualification

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of the university staff, (iii) the university offers agile processes to execute and implement the project, and (iv) the university accepts the patent ownership proposal made by the company and (v) successful experiences with the university staff. The other factors were deemed less relevant by the respondents.

6. Conclusions

The study has shown the importance of creating models for the decision regarding when to use open innovation, bringing a contribution to the literature and to the open innovation practice. It was possible to notice in the interviews that the factors were known by the company when the questions were asked, but the company did not have an organized practice to make a decision on the subject. The company that uses a structured mechanism will be able to reflect on it and improve it over time.

This study has shown, however, that a partnership that tends to be mutually beneficial has its own challenges, which must be addressed in a systematic and careful manner, from the selection of partners and the joint project management. The case study of one of the leading cosmetic companies in Brazil, recognized as one of the most innovative in the country, showed that fifteen factors of the model were deemed relevant by the respondents, confirming the results of the meeting with the participants of the focus group. However, two factors were unanimous among the respondents, when they were asked to select the four most important: **Previous successful experiences with the university staff** and **Knowledge and qualifications of the university staff in the field related to the contract**. Two other factors had preference, but were not unanimous: **The deadline proposed by the university is in line with the company's needs** and **The University accepts the patent ownership proposal made by the company**.

Among the possible partners for establishing partnerships for technology development, special mention to the universities, not only for their technology parks and availability of qualified researchers, but for their vocation to produce unprecedented knowledge. Thus, it is absolutely strategic for an industrial company to consider the possibility of adopting an open innovation strategy with universities (local or not) as a means to not only accelerate its innovation development process, but also to identify new development opportunities that have not been envisioned so far. As for the universities, the establishment of partnerships with companies may be strategic because it opens the door to new forms of financing of their own scientific work, channeling to society the practical applications of the academic knowledge they produce. In addition, the University establishes partnerships with the company's researchers, who have their own culture, values and practices and, therefore, can offer valuable insights into the needs of the industrial world.

Due to the method used, the conclusions cannot be generalized and the limitation of the subjectivity will be always present. This paper analyzed the subject from the company's perspective. It is important to repeat this research analyzing the subject from the university's perspective. Some factors will be the same, but there will be others. The effective relationship between the university and the company depends on knowing what each partner considers important in this collaboration. Moreover, further research could study whether the presented variables will have the same effect in partnerships with upstream partners i.e. suppliers and

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customers. There is also the need to conduct a quantitative research in various companies, enabling the analysis of differences in view of the particularities of the various sectors.

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