STAKEHOLDERS' ANALYSIS TOOLS TO SUPPORT THE OPEN INNOVATION PROCESS MANAGEMENT – CASE STUDY

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ABSTRACT
Open Innovation (OI) is a strategy to buster R&D productivity that introduces business flexibility via an open approach, either to external ideas or to collaborative work. Considering that the OI concept changes the perception of value creation and raises the number of stakeholders that contribute to a single project, stakeholder analysis seems to be adequate to identify the network partners involved in a project for management purposes. The aim in this paper is to propose a set of tools for stakeholder analysis directed to the identification, prioritization and categorization of stakeholders in an OI management environment. The tools were tested, based on a qualitative approach, in a case study in the Brazilian Pharmaceutical industry. The study led to the understanding of the relationships' importance and correlation of stakeholders in four representative pharmaceutical organizations that adhered to the OI strategy. The set of tools were useful to access the incoherence between the importance attributed to a given stakeholder and the kind of collaboration he shares. It revealed that the intensity of the relationships between them is different from a company to another.

Keywords: stakeholder analysis, open innovation, collaborative innovation strategies

1 INTRODUCTION

To introduce business flexibility in the organizational structure [1] is an alternative strategy to the specialist group to improve R&D productivity. Chesbrough [2] affirms that companies can catch flexibility opening up their innovation model to external ideas and paths to market. According to him, if managers are able to open their innovation business model, more ideas will become available for consideration, and many more pathways for unused internal ideas will emerge to unlock latent economic potential, as those ideas reach the market.

The concept of Open Innovation (OI) coined by Chesbrough [3] in 2002 is aligned with the collaboration concept of product innovation engineering. This author has observed that in order to innovate, managers should change the way how they develop their new products. They should figure out that to develop a new product and to penetrate new markets are expensive processes which are not faced easily if performed alone [4]. Chesbrough proposed that companies should work openly, outsourcing projects and/or creating a collaborative environment with a pool of different kind of stakeholders as small companies, other companies (competitors or contract research organization) and academia [5-7]. The collaborative environment of OI is directly influenced by stakeholders, and managers should model their strategies considering the impact of the main involved parts in their value chain [8]. Considering that the open innovation concept advent change the perception of value creation and raise the number of stakeholder that contribute to a single project, the stakeholder management seems to be an adequate tool to identify the partners involved in a product project and, consequently, that contribute to the success of it.

The pharmaceutical industry is peculiarly expensive and competitive. The collaborative strategy is an alternative to organizations of emerging countries, like Brazil. Researchers have already studied the cooperation between pharmaceutical R&D departments and development partners as a strategy to speed up the new product development cycles [7, 9, 10-15]. In Brazil, recent studies [16] showed that Brazilian Pharmaceutical Companies are using the open innovation concept as a strategy to innovate

and get faster into the market. Therefore the pharmaceutical product innovation environment is a potential area of OI research, to test a set of stakeholders' analysis tools.

The aim in this paper is to propose a set of stakeholder analysis tools directed to the identification, prioritization and categorization of stakeholders in an OI management environment. The tools were tested in a case study with Brazilian Pharmaceutical organizations in order to understand the relationships' importance and correlation of stakeholders in the Open Innovation Process.

The remainder of this paper is organized as follows. Initially, it is presented an overview of open innovation concept, further a set of stakeholders' analysis tools are introduced, followed by the models of partnership in Pharmaceutical Industry. Next, the research design is outlined; the sample descriptive characteristics and the design analysis are presented aiming to demonstrate the companies' profiles. Results of the empirical analysis and a discussion are provided, subsequently. In conclusion, some implications and directions for future research are described.

LITERATURE REVIEW

Open Innovation

Rothwell [17] makes predictions about the future of the innovation process dynamics and design the fifth – generation as an interactive process of learning and development. The author argues that an important factor to be competitive is to be a "fast innovator at low costs". To solve this problem, Rothwell [17], in addition to other considerations, suggests that companies must rebuild their R&D departments and include into their core process the participation of external stakeholders [10]. The open innovation concept is closely bound to Rothwell's fifth – generation model because it is a new paradigm in which it is assumed that firms can and should use external ideas, as well as internal ideas, and internal and external paths to market, as they strive to advance their technological resources [18]. Furthermore, it is also assumed that internal ideas can be used by external channels, outside the current business core of the firm, to generate additional value.

Chesbrough [8] affirms that there are three primary areas that firms can focus their activities on: funding, generating and commercialising innovation. The funding innovation is a model focused primarily on supplying fuel for the innovation fire. Here, it's possible to find the venture capital initiatives, government investments in co-operation projects and investments in start-ups and spin offs [19]. The second model, generating innovation, lies under different profile companies with the purpose to discover, explore, codify and create value to an idea or product. And the third model, commercialising innovation, focuses on bringing innovation to market by license or acquisition or simply by selling solutions. This is the profile of pharmaceutical companies like NineSigma, InnoCentive and YourEncore that have the business purpose of finding solutions to companies' development problems in a network of companies, universities, government and private labs [15].

Stakeholder Analysis

Stakeholders can be defined as individuals or organizations that are affected by a project and influence or impact the project via their requirements [20]. According to the PMBoK [21], stakeholders are people or organizations actively involved in the project or whose interests can affect positively or negatively the execution or results of a project. Stakeholders can be classified according to the degree of involvement with a project into primary and secondary. Primary stakeholders are the individuals directly involved in the execution of the project, while secondary stakeholders are individuals or organizations indirectly involved in the project as investors, suppliers and contract firms.

Despite of their classification, to identify the stakeholders is an important task because they comprise different degrees of responsibilities, which vary accordingly to their contribution and commitment with the project. The management of stakeholders' involvement in innovation projects is a task of growing importance nowadays. An important component of stakeholder management is stakeholder

analysis [22, 23]. Proponents for stakeholder analysis argue that it may increase the project manager's ability to anticipate opportunities and problems for the project at a time when the project team still has time and opportunity for maneuvering. Findings from the stakeholder analysis should make the project manager capable of determining how much and what kind of attention each stakeholder should get and, subsequently, how to interact with each stakeholder. This is especially important in complex collaborative R&D research projects such as those the pharmaceutical companies undertake in an open innovation approach.

A number of tools have been proposed to better understand who the stakeholders are and how they impact project development. According to Karlsen's tool [24], for instance, stakeholders can be classified inside a matrix subdivided in four parts which correspond simultaneously into four different stakeholder types. The matrix purpose is to evaluate stakeholders according to their collaboration and impact in the project and classify them under four classes: mixed blessing, supportive, non-supportive and marginal.

To each stakeholder typology, Savage [25] proposes a different strategy to handle with them:

- Collaborate strategy: mixed blessing stakeholders impact and collaborate highly with the project, so a collaborative strategy seems to be the best way to guarantee mutual trust and benefits for both parts.
- Involve strategy: supportive stakeholders are often ignored as stakeholders to be managed and, therefore, their cooperative potential is overlooked. Through an involve strategy the project manager can encourage a potential cooperation and extend the relationship.
- Defend strategy: non-supportive stakeholders are best managed using a defensive strategy. The purpose is to reduce the dependence that forms the basis for the stakeholders' interests in the project.
- Monitor strategy: marginal stakeholders are those who have a very low potential to impact and collaborate with the project. Recognizing these stakeholders the project manager can minimize the project expenditure of resources.

The importance of each stakeholder may be accessed with the Stakeholder Importance Analysis matrix [26] adapted from Analytic Hierarchy Process (AHP) [27] as presented in Figure 1.

Stakeholder Importance Analysis Matrix	Stakeholder A	Stakeholder B	Stakeholder C	Stakeholder D	Stakeholder E	Total
Stakeholder A		3,00	1,00	0,11	3,00	7,11
Stakeholder B	0,33		9,00	3,00	1,00	13,33
Stakeholder C	1,00	0,1		0,33	0,33	1,77
Stakeholder D	9,09	0,33	3,03		3,00	15,45
Stakeholder E	0,33	1,00	3,03	0,33		4,70

Figure 1. Stakeholder Importance Analysis matrix example

To perform the stakeholders' importance analysis the interviewees should compare stakeholder priority by answering the question "How much stakeholder A is more important to your innovation projects than stakeholder B?" for each pair of stakeholders. This was performed by assigning in the upper matrix diagonal a number that follows a five level scale (9, 3, 1, 1/3, 1/9), where 9 represents "much more important", 3 means "more important", 1 represents "equally important", and 1/3 and 1/9 represent, respectively, "less important" and "much less important". The bottom diagonal of the matrix corresponds to the inverse of the values in the upper diagonal. The total for each row represents the sum of the values of each line and demonstrates the degree of importance of each stakeholder to the company's innovation projects.

Silvestre and Dalcol's [28] approach is used to analyze the relationship intensity among stakeholders. The type of relationship is classified as intra and extra-province. The intra-province corresponds to relationships between stakeholders of the same industrial cluster. On the other hand, the extra-province corresponds to relationships between stakeholder of different industrial clusters which include other city, state or country. The intensity of the relationship was classified as:

- Strong (S): relationships with formal cooperation R&D instruments (contract). Intense knowledge acquisition and technological capabilities.
- Moderate (M): relationship with training of employees in Brazil or abroad and incorporation of technological capabilities. More active position and acquisition of knowledge and technological capabilities.
- Weak (W): hiring of specialized technical consultancy services, domestic and internationally. More passive than active position.
- Very Weak (VW): relationship with exchange of information and knowledge at the informal level. Passive posture without effort to incorporate knowledge in a systematic way. Acquisition of knowledge and technological capacity small.

The concomitant use of these tools is not frequent in literature.

Models of Partnerships in pharmaceutical industry

Nowadays it is rare for a single pharmaceutical organization to be responsible for the entire research, development and commercialization process required to generate successful innovations. Partnership seems to be a standardized and potentially valuable innovation mechanism. Co-development partnerships are becoming increasingly effective as a way of improving the productivity of the research and development process or the innovation effectiveness. Using alliances to acquire new technologies or skills can strengthen collaborative companies and improve their production efficiency and quality control.

Due to the necessity of using resources more efficiently, companies, especially in the pharmaceutical industry, led the adoption of strategies such as outside contracting, partnering and joint ventures. Types of collaboration in the pharmaceutical industry are summarized in Table 1.

Table 1. Types of collaboration in the pharmaceutical industry

Type	Relationship Duration	Usual Partner	NPD Phase
Outsourcing/Value Supply	Short	Clinical Research Organizations	Development and Post Development
Licensing	Fixed	Other organizations	Development and Post Development
Consortium	Middle	Universities, Research Institutes, other organizations	Pre, Development, and Post Development
Strategic Alliance	Flexible	Universities, Research Institutes, other organizations	Pre Development, Development
Joint Venture	Long	Other organizations	Independent of NPD
Network	Long	Universities, Research Institutes, other organizations	Pre, Development, and Post Development

In the case of pharmaceutical industry, outsourcing strategies usually involves clinical research organizations (CRO). CROs result from the pharmaceutical companies' necessity to provide proof of efficacy for new drug applications. Therefore the relationship is more intense along development and post development phases of new product development (NPD) process. However, independent on the kind of outsourcing solution a company may adopt, concerns with relationship quality and the choice of an adequate occasion to establish the partnership are essential factors to the co-development success.

Consortium, meanwhile, consist in a predefined number of companies working together in a specific project. This is the most common type of cooperation when the partnership involves cooperation between firms and universities along all NPD phases. The role of university as a key contributor to stimulate innovation generation and economic development has increased recently. University/industry collaboration (UIC) activities have been investigated from either the university or

industry points of view and the interactions of activities may differ in terms of level of ongoing involvement.

University-firms alliances may involve either single transaction, such as individual projects, or in long-relationships as part of an overall R&D strategy. In the first approach, the government acts as the primary funder of academic research, where the research is disseminated as a "free good" to society through scientific publication and it is part of development and post development phases of NPD. In the second approach, the government funding still exists, but the university invests in enabling capabilities that allow it to better fit with its industrial partner needs and to form a long-term relationship, and it is independent on the NPD process phase.

Given the specific characteristics and interests of universities and industries in R&D cooperation, the field is characterized by high uncertainty, high information asymmetries between the partners, high transaction cost for knowledge exchange, high spillovers and restrictions for financing knowledge production and exchange activities. So, in order to university and industry to establish and sustain positive collaboration relationships, they must gain mutual benefits from the partnership. Despite the opportunities afforded by working together, however, companies and universities still need a systematic approach for capturing the full potential of such relationships [29] as the stakeholders analysis approach.

RESEARCH DESIGN

This is a multiple case study design according to Yin [30] with the purpose to test a set of stakeholder analysis tools in the open innovation strategy. Case study research seems to be appropriate in this case because this study intend to be an exploratory research focusing on collect information to understanding organization's behavioral and the dynamic behind innovation process and stakeholder management. Therefore, with intend to respond the objectives of this paper; this study was structure in four steps depicted in Figure 2. After the interviews and content analysis, the innovation stakeholders of each organization were identified and classified and a Brazilian Innovation Network was designed.

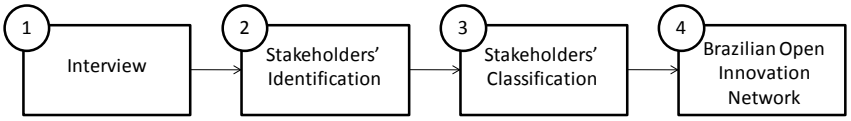

Figure 2. Research Methodology

The pharmaceutical field is the target of this research since it holds high innovation capabilities and capacities. Moreover Chesbrough [31] cite it as potential users of open innovation because for the significant amount of money on innovation invested by these managers in a scenario of few guaranties of success. Table 2 provides brief descriptions of the firms that were subjects of this study.

Table 4. Brief description of participating companies

Company	*Segment*	*Company Business*	*N. of Employees*	*Company Age*	*Profit (U$ million)*	*% of Profit invested in R&D*	*N. of R&D Projects*	*R&D divided in Business unit*
A	Drugs	Similar drugs	1700	12 years	260	7% which 2,5% of this to incrementhal innovation)	173	No
B	Cosmetics	Cosmetics and food supplements.	3500	37 years	2000	3%	Data not provided	Yes
C	Drugs	Hospital drugs	2058	38 years	280	6%	28	No
D	Biotech	Monoclonal Antibodies	42	3 years	Data not applicable	Data not applicable	4 research lines which many projects	No
E	Drugs	Generic drugs	4200	45 years	700	6% which 5% of this to radical innovation	300	No

The Interviews

In this empirical study, the firms that were selected were chosen purposively, accordingly to qualitative requirements, with the purpose to cover the main segments of pharmaceutical industry and to ensure that open innovation practices are being used. The sample includes four representative Brazilian Pharmaceutical Companies from the drug, biotechnology and cosmetic segments, all situated in São Paulo state, under different stages in terms of the life cycles of their main products.

Data collected were in the form of interviews with senior R&D managers as managing directors. The semi-structured interviews lasted from one to two hours and numbered four in total (one per organization). All the managers and directors received a brief set of questions prior to the interviews, which helped them prepare for the interviews. Questionnaires contained key questions with the purpose to understand the stakeholder management in their open innovation processes and types of relationship existed between organizations and innovation partners. Finally, the interviews were recorded and transcribed. The text was analyzed using content analysis as describe by Bardin [32].

Stakeholder Identification and important analysis

Based on the interviews, the innovation stakeholders of each company was identified and allocated in a importance analysis matrix [26] adapted from Analytic Hierarchical Process (AHP) [27] as described in the literature review. This matrix consists in a same number of lines and columns, both containing the innovation stakeholders identified in the interviews, last section.

Stakeholder Categorization

Next to the identification and prioritization of stakeholders, the interviewees were invited to classified each stakeholder in a second matrix illustrate as Figure 3. This second matrix was adapted from [24] and its purpose is to classify the stakeholder according to their Impact and Contribuition and/or Commitment in innovation projects. The stakeholders were allocated in the cells considering a scale of 1 to 9 with three levels of evaluation: low (1), medium (2) and high (3) each one subdivided in three sublevels (inferior (1); equal (2); superior (3)).

The allocation of each stakeholder in the matrix indicates its classification as discussed in the literature review and depicted in quadrants of Figure 3, mixed blessing (Q1); supportive (Q2); marginal (Q3) and non-supportive stakeholders (Q4).

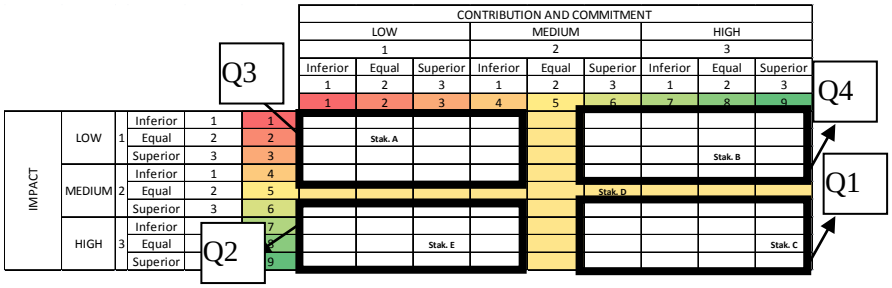

Figure 3 Commitment and Impact Stakeholder's Analysis

Statistical Analysis of Stakeholders Matrixes

The matrixes of importance and classification of stakeholder were analyzed under non parametric statistics. Firstly, to analyzed the stakeholder's importance matrix it was used a Chi-Square statistical test to identify correlation between stakeholders of each company according to their importance degree (SPSS® v.15.0 software) [33]. Secondly, to analyze the stakeholder's importance matrix versus the Commitment and Impact Stakeholder's matrix it was used the Spearman coefficient which measures the intensity of the relationship between the variables, in this case three variables: importance degree, commitment degree and impact degree. The Spearman coefficient varies between -

1 and 1. The variables closer to one of the extreme point are more associable. The negative sign of correlation means that the variable vary in the opposite direction, which means that the higher categories of one variable are associated to the lower categories of the other variable.

Stakeholders' relationship intensity

The Brazilian Open Innovation stakeholders' relationship intensity (network) was draw using the data from the identification phase and a third worksheet in which the interviewees were invited to classify the type to relationship exist between the company and the stakeholder and the intensity of this relationship based on the Silvestre classification [34] from the literature review (Strong-S; Moderate-M, Weak-W, Very Weak -VW). The stakeholders were, also, divided in segments as their profile and function into the innovation project as: Universities/Institute Research, Clinical Research Organization (CRO), Suppliers, Regulation Agency, Fostering Agency and Others.

RESULTS AND DISCUSSION

The stakeholders' identification led to a list of common partners among the four organizations. The universities, CRO, fostering agencies, suppliers, were numbered. Further, the data from the importance matrix analysis, from the four companies was computed. From these totals, and assuming that the importance of all stakeholders is not significantly different at 5%, it was made the Pearson chi-square test on these results in order to identify if the equal importance hypothesis can be accepted.

The Pearson chi-square test shows that to each company the results of stakeholders totals was the same in terms of p-value, which means that the results were highly significant (p-value < 0,0001). The differences between the importance of each stakeholder is present, from company's A stakeholders for illustration purposes (Table 5), through the standardized waste analysis as Pereira [35]. The standardized residuals column presents values that follow a standardized normal probability distribution. It means that in a significant level of 5%, it can be considered significant values that are inferior to -1,96 or superior to 1,96. So, based on that, it is possible to observed 3 distinct groups which are seconded in the Table as: (1) The stakeholder's group that are significant the most important in relation to the others (on green); (2) The stakeholder's group that do not differ from the equality supposition (black) and (3) The stakeholder's group that are the least important than the others considering the hypothesis that every stakeholder has the same importance (red).

Looking carefully to Company A, it is possible to see that only the University/ Research Institute 7 stand out with significant results and for this reason it is considered the most important stakeholder to the company. On the other hand, the Fostering Agency 2, 8 and 6 and the Regulatory Agency 10 and 13 was classified as the least important to the innovation projects of the company.

Following, Company B, considered as the most important stakeholders their intern R&D and project management department but unconsidered other intern department as Marketing and Law. Moreover, the Fostering Agencies and Regulatory Agencies seem to be not important in contrast with the rest of the stakeholder listed.

Controversially, Company C interviewees have listed many Universities and Research Institutes as stakeholders on their innovation projects and a prioritization Pareto chart was created with the totals (see Figure 1) of the matrix data. The standardized wastes results show that the Universities cited were not significantly important to the company. The manager seems to prioritize much more the Fostering Agencies and the internal departments of the organization, than the Universities. These results go on the opposite side of the open innovation model that the company declares to adopt.

Further, Company D results analysis shows that the managers considered important not only the Universities and Research Institutes but also Regulatory Agencies and one of the CRO cited. In this category stands out the University/Research Institute 8, CRO 8 and Regulatory Agency 1.

Table 5. Standardize Residuals Analysis of Company's A Stakeholders

Stakeholders	Total	Resíduos Padronizados
Fostering Agency 8	24,30	**-3,52**
Fostering Agency 2	24,30	**-3,52**
Fostering Agency 6	24,30	**-3,52**
CRO 9	60,42	1,73
Supplier 4	52,39	0,55
CRO 6	39,66	-1,30
University / Research Institut 9	39,66	-1,30
University / Research Institut 12	45,75	-0,42
University / Research Institut 11	54,42	0,85
University / Research Institut 10	36,53	-1,76
University / Research Institut 7	70,52	**3,23**
University / Research Institut 13	42,00	-0,96
University / Research Institut 2	51,15	0,37
Regulatory Agency 1	45,70	-0,42
Regulatory Agency 10	16,96	**-4,57**
Regulatory Agency 13	4,10	**-6,39**
R&D Departament	60,73	1,78
Project Management Departament	60,73	1,78
Knowledge Management Departament	60,73	1,78
Competitive Innovation Departament	60,73	1,78
Regulatory Departament	60,73	1,78
Patent Management Departament	60,73	1,78
Financial Departament	60,73	1,78
Manufactoring	60,73	1,78
Marketing Departament	60,73	1,78
Medical Consultant Departament	60,73	1,78
Joint-Venture	60,73	1,78
Others 1	60,73	1,78
Total	**1360,89**	---

However the Company are a start up, the results of the standardized residuals results demonstrate that the Fostering Agencies are not so important to their innovation projects and controversially to the Pareto chart, despite the company be a biotechnology company that develop monoclonal antibodies and do not have any kind of labs to do their research, the CRO's, responsible for the clinical test research, seems to be not important to the company.

Analysis of the impact and commitment of stakeholders in open innovation projects

Considering the importance attributed, as well as, the impact and commitment level of each stakeholder, it was used the non-parametric Spearman correlation coefficient to verify the correlation between the scores given to these variables. The option to use a non-parametric measure is function of the qualitative not continuous scores given. The correlation analysis was performed to all the stakeholders independent on the company. It was observed that, generally, the correlation is positive. This means that the stakeholders that are considered the most important are also the ones who present a high level of commitment and impact in innovation projects. This behavior was not observed, only, for Company B. In this case it was observed a negative correlation coefficient which implies that the most important stakeholders are least striking to this company.

However, the results of the correlation between impact and importance are usually not significant including to company B, significant differing only Company C (p-value <0,05). The fact of these results do not present a significant degree indicates a lack of significant correlation pointers between variables. Positive results can be observed, also, between the importance degree and commitment level variables. This second correlation it was not observed just on the Company D'datas. Table 6 summarized the data of the Spearman correlation analysis of all stakeholders per company.

Table 6. Spearman correlation coefficient between importance, impact and commitment degree of Stakeholders per company

Company	Impact		Commitment	
	r de Spearman	p-valor	r de Spearman	p-valor
A	0,355	0,063	0,844	< 0,001
B	-0,105	0,602	0,399	0,039
C	0,650	0,001	0,681	< 0,001
D	0,097	0,636	0,124	0,547

When just the external stakeholders were analyzed, the results pointed out a little difference. The analysis showed that while the importance – impact relation is negative to Companies A and B, Companies C and D show a positive correlation. These results are significant to companies B, C and D. This present a divergence because while companies B and C judge the most important companies the leaser striking to their innovation projects, company D go in opposite direction, which means that for it the most important stakeholders are also the most striking.

Additionally, if the correlation between importance and commitment level of the external stakeholders are analyzed, the result shows that there is a positive correlation among these variables to companies A, B and C. For Company D, however the result has also showed a positive correlation, the data was not statistically significant, e. g., there is no evidence of significant association in this case. Table 7 provides a summarized of the Spearman correlation analysis to only external stakeholders.

Table 7. Spearman correlation coefficient between importance, impact and commitment degree of External Stakeholders per company

Company	Impact		Commitment	
	r de Spearman	p-valor	r de Spearman	p-valor
A	-0,027	0,915	0,803	< 0,001
B	-0,547	0,035	0,569	0,027
C	0,535	0,012	0,576	0,006
D	0,097	0,636	0,124	0,547

Brazilian open innovation network in pharmaceutical companies

Based on the interviews, the stakeholders listed by the companies and the intensity of relationship it was possible to draw a network of stakeholders that are common to more than one company, as demonstrated in Figure 4. The figure shows that the intensity of the relationship of partnership can be different to company to another company for a same stakeholder. This figure does not show very weak relationships between stakeholders and companies because, according to the definition, a very weak relationship, in this study, is based on knowledge exchange in an informal level. This kind of relationship was frequent just between internal departments of each company.

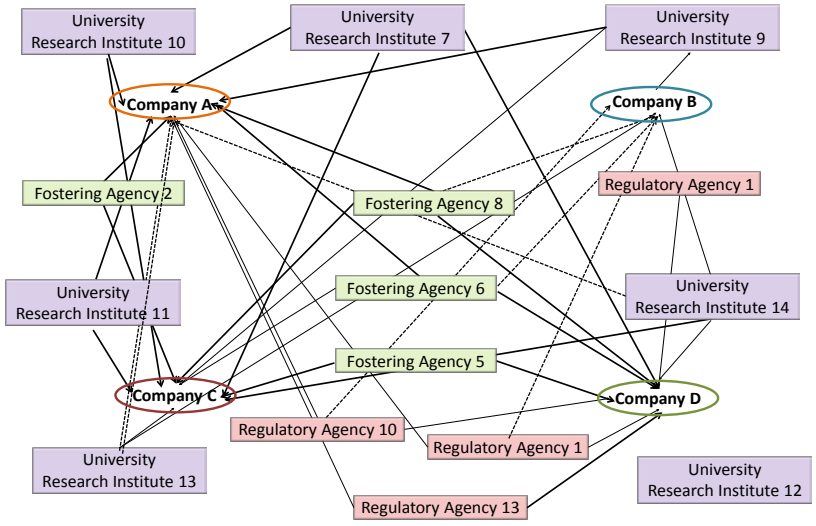

Figure 4. Network of stakeholders that are common to the companies.

Legend: —— Strong —— — Moderate — — — Weak ---------- Very weak

FINAL CONSIDERATIONS

The set of tools for stakeholders' analysis proved to be adequate to identification, prioritization, importance and network description. The analysis of the stakeholders listed by the companies'

managers it was possible to observe that it is frequent a synergic behavior in search for complementary knowledge to improve their innovation projects. The most common partnership from the four companies are the universities and research institutes in a consortium business model, and secondly, they also outsource CRO services and suppliers to perform complementary tasks as clinical test or new materials, respectively.

The non parametric statistical analysis was useful to reveal some tendencies, sometimes contradictory. For instance, despite the managers have listed the universities as the main source of new ideas and innovation projects, therefore, their main partner, the statistical analysis of Chi – Square test showed that only few universities are considered important to the companies' innovation projects. These inconsistencies should be further analyzed for managerial decision making, considering the collaborative environment of open innovation or of other collaborative approaches.

The set of tool for stakeholders' analysis provided an overview of a fragment of an open innovation network. Based on the network it is possible to observe that there are stakeholders that are similar to more than one company. However the intensity of the relationship can vary from a company to another. The Spearman analysis demonstrated the variation through the correlation between the variables importance, impact and commitment. It also suggested that, for almost all the cases, the importance has a positive correlation with the commitment degree.

As reviewed in the literature, a good stakeholder analysis may impact innovation project success. The open innovation model is supported by a collaborative work as other innovation approaches do. Therefore, the number of stakeholders involved in a project may increase, bringing proportional challenges. The set of tools for stakeholder analysis may support the management of open innovation or other collaborative innovation strategies by, on the one hand, making explicit the relationships between all actors in the innovation network and, on the other hand, highlighting which relationships are considered important and significant by the actors themselves. In this way, critical stakeholders in an open innovation network can be identified and specific guidelines for relationship with these critical actors can be developed by the different actors.

The proposed tool can also be employed in other settings. Different industries will have their own classes of stakeholders, but the overall application should be very similar to what was reported in this paper. Similarly, different country and market realities will result in specific stakeholder networks. Eventually, the tool proposed in this paper may be used to compare different OI networks according to stakeholder identification, prioritization, and relationship importance.

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