

Mapping of the Challenges for the Open Innovation Model's Implementation in Service Sector

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Abstract—The purpose of this article is to provide a conceptual mapping of challenges in the open innovation model's implementation in service sector. For this aim, content analysis of scientific articles was performed using MAXQDA10, primarily in the industries of telecommunications, pharmaceutical, biopharmaceutical and automobile services. These articles were selected from a search using data base ISI Web of Knowledge and web content analysis. The open innovation's challenges for its implementation in service sector were grouped in three macro challenges cited as the most relevant by Chesbrough and Brunswicker [1]. These challenges are presented in three stages: organizational change management, external relationship management with innovation and commercialization sources and effectiveness of intellectual property protection.

Index Terms—open innovation, service innovation, challenges

I. INTRODUCTION

Factors such as the workers mobility, the existence of venture capital, the reduction in life cycle of products [2], the high cost for the new technologies development [3] or the existence of key external knowledge in public and private organizations are leading to rethink the traditional approach known in the academic literature as Closed Innovation [4].

Companies have begun to actively involve consumers, suppliers and other business stakeholders in the products and processes innovative creation process [5]. A new approach has been called Open Innovation and in spite of the fact that the term was created just a decade ago, by Professor Henry Chesbrough in 2003, this concept has been of interest in the scientific community [6].

In the Open Innovation model companies open their R&D processes boundaries in order not only to implement ideas from external entities, but also to market their own ideas [7]. In other words, the new approach to innovation is based on two main dimensions, technological exploration and exploitation, which involve different kind of practices and, in consequence, implementation challenges [2].

The Open Innovation implementation can be both in manufacture and services. Nevertheless, research on open innovation has been primarily focused on the development of the theory regarding to manufacture [8]. Therefore, and because of their distinctive nature, there is an area of research and an opportunity to analyze the characteristics associated to the application of this model in the service sector.

According to the World Bank (2012), the services sector contributes with 70% of global GDP, 72% in the European region, 79% in the U.S. and 63% in Latin America and the Caribbean [9].

That is the reason why the services sector is considered key to economic growth in either first world countries or emerging countries. This is the case of India, where its contribution to the GDP is up to 57% and Colombia, where the contribution is up to 59% in 2012 [9].

Because of its importance, it is relevant the deep understanding of the R&D processes in services focused on the new model of open innovation. This research has developed a framework based on the challenges that either service or manufacture companies need to overcome with the purpose of improving their R&D processes through the Open Innovation model implementation (primarily in the industries of telecommunications, pharmaceutical, biopharmaceutical and automobile services). In this respect, this work will contribute, to some extent, to a better understanding of the phenomenon and will help to discover and identify future avenues for research.

II. LITERATURE REVIEW

Traditionally, innovation processes had been managed through internal R & D departments by large companies. In this sense, those departments were a strategic asset which constitute a competitive advantage over other companies [10].

Moreover, they made bigger the difficulty of entering into the market for competitors, maximizing the innovation and facilitating business growth through not only improved products, services and processes, but also by radical innovations [11].

This kind of process, in which large companies internally explored, developed, and commercialized

technologies has been called Closed Innovation model [4]. In “The era of Open Innovation”, Henry Chesbrough describes the Closed Innovation model as in the Fig. 1. The company’s boundaries, working as a waterproof membrane inwards, have a large number of projects in the research area, which is funnel-shaped, towards the development area. Thus, few developments are released to the market.

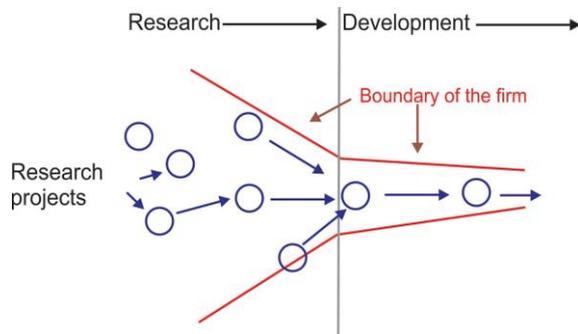


Figure 1. Closed innovation model [4]

According to Lamoreaux and Sokoloff (2012), the emergence of R&D labs is a phenomenon that was born in America in the early twentieth century, becoming a dominant model after the second world war [12].

Several historians have documented the existence of broad innovation markets preceding the strengthening of intellectual property laws [7]. Indeed, finalizing the nineteenth century, innovation was acquired by small and independent researchers or small research companies like Edison's Outfit; who managed to commercialize their inventions by acquiring potential customers through intermediaries. [12].

Currently, the context of innovation is similar to the one that existed in the nineteenth century markets. Performing R & D activities is not enough to get innovative results. This results from the fact that new combinations of resources, ideas and technologies are needed in order to create an environment where innovation can be generated as a consequence of knowledge flows both inward and outward the organization [13].

Companies need to exchange ideas with external knowledge sources such as customers, suppliers and even competitors to create products and / or services through innovative information exchange [14].

Transition to a more open model of innovation is driven by significant changes in the competitive environment such as the increased dynamism and turbulence, the globalization of markets and business activities, the increased competition into the market and the fast pace of technological development [15].

This new paradigm has been called The Open Innovation model, which has had an incremental impact that can be proved by more than 1500 publications between 2003 and 2014.

Chesbrough uses the Fig. 2 to represent this model. It is clear that the boundaries between a firm and its surrounding environment are more porous, enabling knowledge to go easily inside and outside by different

channels and at different phases of the innovative cycle.

According to a previous study, a total of 605 SMEs in the Netherlands with the aim of finding open innovation practices in the service sector, had market issues as the main reasons for its adoption. Those companies have as goal to give their customers a better service or to find new market segments and opportunities [10]. As reported by the study, 31% of that companies participated in joint ventures, 36% had interest in other firms and the 61% integrated users in the innovation process; all with the aim of acquiring knowledge, setting industry standards, getting additional resources and expanding their social networks to share the risk or reduce costs [16].

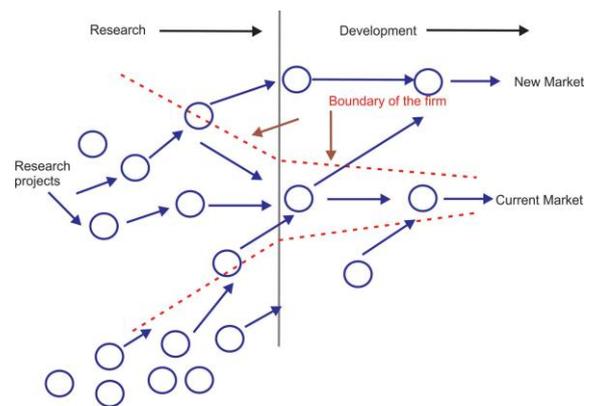


Figure 2. The open innovation model [4]

On the other hand, establishing new partnerships, exploring new technology trends and identifying new business opportunities are the strategic activities identified by Chesbrough and Brunswicker in a survey of more than 2840 large enterprises in the European Union and the United States. Results in the research show that efficiency is not considered as a relevant factor in the open innovation model implementation [1].

In addition, there is a consensus among different authors in which the cooperation between customers, consumers and suppliers is the preferred kind of relationship, according to different companies interviewed.

In the Chesbrough & Brunswicker's work [1], companies give a score of 5.17 (on a scale of 1 to 7 points, with 7 being the highest score) to the customer relationships while supplier relationships were scored with 4,51 and final customers were scored with 4,30. Agreeing with the above, other study in the service industry in South Korea done by Moon, in 2011, puts in the first place the relations with customers and consumer, having it 54% of responses; similarly, consumers are considered the most important source of innovation followed by competitors and suppliers in the automotive industry. [17].

This seems to be the same case as the EUROSTAT [18], where relationships with suppliers and consumers are the most common among the companies interviewed, having a percentage of 17% and 14% respectively. However, there is no consensus among some authors yet. As an illustration there are the case of Chesbrough and

Brunswick, where relationships with universities obtain a score of 4.88; and the Korean work, where such partnerships with either public or private research centers got the lowest importance. This lack of consensus is also given to the EUROSTAT, where such cooperation is less common, having just 9% of the companies interviewed. Moreover, relations with competitors got a little influence score (2.54) in the work of Chesbrough and Brunswick while, in the study of Moon, they obtained the second highest position, with 50% utilization.

Either companies that use information from market sources or internal sources as those that perform collaborative scientific basis are more likely to generate more innovations to the market; while those using information from suppliers have a negative influence on the same measurement. Clearly, companies that make cooperation with universities and research centers tend to generate more radical innovations [19].

Dahlander and Gann (2010) argue that Open Innovation goes beyond a conflict between the open and the closed model, stating that open innovation can occur in varying degrees of openness [20]. Therefore, they could be located from the closest to the most open ones. Additionally, Open Innovation can be applied not only in the industry of high technology, but also in that known as low-tech industry, such as those devoted to oil refining or retail, which rely on technological innovation, from ICTs to complex manufacturing processes [4].

Open innovation is associated with a wide range of activities, which can be classified into two categories: exploration (Inbound Open Innovation) and exploitation (Outbound Open Innovation) technology [7].

Technological exploration refers to the process of search and integration of external knowledge, which includes networking and collaboration with other organizations such as universities, suppliers, partners, etc. and even the same customers in the development of products, services and internal use of intellectual property licenses (in-licensing), among others [7].

This introduction of external knowledge is positively related to the productivity of internal R & D. For example, firms complement internal efforts and innovative results obtained using open innovation strategies [21].

Technological exploration activities are the most used, according to Chesbrough and Brunswick [1] and Bianchi et al. [22]. In their studies, 35% and 62% of the projects for the companies interviewed, respectively, used this type of practice.

The use of these technological exploration practices generate large benefits, especially for small and medium enterprises, who according to the study by Parida et al. [23], where companies of a total of 252 SMEs in the high technology sector in Europe, say the ease of implementation of these activities generates positive impacts on process R & D.

However, this is contrary to what was argued by Gans and Stern who, in their research results, assert that there

is a high degree of risk when a company opens its borders to external ones. As they say, Startups are at risk of exploitation, of losing autonomy and not to commercialize their innovative ideas when they are involved in the trading of ideas [24].

On the other hand, Technological development is seen as a practice that allows the use of technological capabilities through the use of internal and external marketing channels. Exploitation includes, among other practices, the creation of spin-off companies and engagement in product development by licensing other firms (out-licensing) its technology.

Many companies are unable to benefit from all its technological knowledge and therefore the licensing process to third parties allows them to capture additional value. A clear example of that are IBM and Dow Chemical which get large sums as a result of licensing their inventions. Other case is Texas Instruments, who receive 50% of its revenue from licensing others.

Furthermore, a study performed to 136 industrial companies by Lichtenthaler [25], shows how opening organization boundaries towards the exploitation of technology leads to an indisputable positive effect on revenue.

Also, according to Lichtenthaler [25], the degree of technological turbulence, the transaction fee of technology markets and the intensity of competition in these markets positively strengthen the effects that technological development has. Nevertheless, the degree of protection caused by patents does not facilitate the implementation of open innovation practices.

These technological exploitation practices are taken with less degree of importance than the technological exploration ones are in large companies. (Just 3.25 in a 7 points scale) [1].

This knowledge transfer resistance is given by the fact that companies are afraid of strengthening their potential competitors because they had sold their patents. However, companies that perform that practices have an IP strategy which only allows them to sell those patents that are not more interesting or do not have the possibility of development within the firm [26].

Open innovation practices depend, among other factors, on the type of innovation that is sought. Said in other words, the role of external resources would be different depending on whether the innovation is done in products or processes [27].

Furthermore, that practices and the kind of partners a firm has vary depending on the innovation process phases of the industry due to the fact that they are characterized by different requirements in terms of level of investment, risk, uncertainty and the need either to explore new knowledge or to exploit the existing one [28].

In the work performed by Bianchi et al, it is shown that the practices of technological exploration (Inbound) in the Biopharmaceutical Industry are generated while the stages of idea generation and research (identification and target validation, optimization and pre-clinical trials) are

in course. Moreover, technological exploitation practices (Outbound) in the same industry are mainly used in the stages of development and commercialization [15].

Depending on the size of the company may be observed a special distribution of the different practices. Returning to the study by Bianchi et al. (2010), Small companies implement exploration practices by 70%, while large ones made it by 44%. That situation is due to the maturity of large companies, which have a large number of drugs in development and wide market coverage. In consequence, they can have access to lots of partners to commercialize their innovations. [15].

That idea is in line with the results of Christensen et al. (2005), who claimed that small businesses in the consumer electronics industry tend to close their technological base, it means, to perform fewer exploitative practices. Moreover, the same study highlights the interest of big business in in the acquisition of new technologies (technological exploration) [29]. This interest in the external knowledge is a result of that fact that large firms have a knowledge base that facilitates their absorption [30].

Moreover, traditional industries give more importance to relations with members of its ecosystem of innovation, adopting and integrating technologies from high-tech industries and collaborating with customers and suppliers to resolve problems [31].

III. METHODOLOGY

The methodology used for the development of this project consisted in the content analysis of scientific papers that were obtained from academic databases. In addition, that information was supplemented with extra web documents.

The search was conducted in the database ISI Web of Knowledge. Articles published since 2003 were primarily considered because that was the year when the concept of open innovation was born.

The equation was build matching the keyword "Open Innovation" with "Challenges" or "Service" or "Service Challenges" or "Manufacturing Challenges". An initial sample of 623 articles were obtained and sorted by the number of citations. Taking that list as an input, titles and abstracts of the articles were read, analyzed and finally filtered in order to align the search towards the goal of the research, all having in mind that the idea consisted in identifying the challenges for the implementation of open innovation focused on service sector.

At the end, 55 documents were fully reviewed and coded according to the main challenges identified by Chesbrough and Brunswicker. The process was made through a qualitative analysis software called MAXQDA10.

IV. RESULTS

This paper presents a framework about the challenges that companies in the service sector (primarily in the industries of telecommunications, pharmaceutical, biopharmaceutical and automobile services) face when

they are trying to implement an open innovation model based on three major dimensions (Appendix A).

The three dimensions, previously identified by Chesbrough and Brunswicker's work [1], include internal organizational change management, external relationships management with sources of innovation and marketing effectiveness in the protection of intellectual property. Within each of these elements more challenges were identified by coding information from the scientific papers finally included in the sample.

Regarding to the organizational change management [28][32] definition, taking into account the state of the art on the subject, there was considered a strategy of opening as the extent to which companies decide to open their innovation processes [7] [33] [34] [35] [36] [37] [38] [39] [26] [40] [41] [17] [42] [43] [44] [45] [46] [21]. Besides, the role of organizational culture change that must be made, based on the different organizational subcultures, is highlighted [17] [42] [47] [48] [43] [40] [49] [50].

Additionally, there is a change related to the management practices aimed at changing existing processes, organizational structure and performance metrics for an open innovation initiative [51] [52] [53] [40] [54] [43] [49] [44] [55] [3] [56] [37] [1]. This item is considered to cross the main challenges due to its presence in the stages of planning, execution and completion of an innovation project of this nature.

Referring to the external relationships management, defining a search strategy is incorporated as the main element [57]. This process includes the choice of opportunities to work, its evaluation, the potential allies recruitment, the capture of value by creating knowledge capacity or complementary assets acquisition and finally, the innovative supply market offer [49] [44] [26] [22] [58] [59] [60] [61] [62] [56] [63].

As a final point, important aspects are included in the definition of a strategy for protecting intellectual properties. It will depend not only on the type of practices used but also on the nature of the innovation project [64] [42] [65] [66] [67] [68].

V. CONCLUSIONS

The choice of which parts of the value chain should be benefited by the open innovation model and types of collaborations to use are a strategic decision. There is necessary to balance internal and external R & D to be able to obtain benefits from the knowledge that comes from third parties. This is because of the relationship of 'inverted U', between the rate of external activities of R &D and the innovative performance of a company.

On the other hand, the change in organizational culture is cited as one of the main challenges when the adoption of the open innovation model is performed. To address that goal, it is necessary that the company considers diversification of organizational culture for each of the functions and departments that comprise it. This is because there is a global culture of open innovation that can be interpreted from a single perspective. As different units have diverse subcultures, different approaches that promote the implementation of open innovation should be

identified.

The emergence of the NIH and OUH syndromes may have been originated from past negative experiences, lack of experience or motivation, or due to a system of incentives that reward internal technological development. To overcome the NIH it is fundamental to integrate people into the decision making process since the early stages of implementation.

There are a number of studies related to NIH (Not invented Here), where that syndrome is taken as a barrier to the implementation of this model. There are authors who point out that the problem lies on the belief that seeking solutions outside the company, including in the same laboratories, means to admit failure.

The shift towards open innovation requires management commitment, which allows generating a change in strategy and organizational culture through initiatives. However, there is also the belief that major changes must be driven from an operational base. The support of management becomes an important resource in the implementation when this basis is convinced of the initiative.

Furthermore, there is a traditional approach of incentives based on closed innovation, which includes, for instance, an evaluation and a promotion of workers based on the number of successful patents. However, there is essential a structure of incentives that allows and encourage workers to an open approach through promotions.

The implementation of the model of open innovation is usually driven by core equipment, enabling an agile execution of the open strategy, creating connections between the business units and the potential sources of innovation. Workers who belong to these teams must have specific skills that promote the implementation.

Additionally, there are two approaches to manage the innovation practices. The first one, or the formal approach, includes clear strategy and routines documentation, standardized processes and the use of metrics to measure and review the impact of open innovation. The informal approach corresponds to the organizational culture, norms, values and individual relationships. According to Chesbrough and Brunswicker [1], the informal approach is the most relevant one in the implementation of open innovation. However, there is vital to make a change in organizational structure processes and metrics.

Also, defining a search strategy is vital while starting open innovation initiatives. It can be achieved by using the model of Fetterhoff and Voelkel [57], which intends to carry out an opportunities research and assessment, followed by the recruitment of potential allies, the capture of value through marketing and the delivery of innovation supply.

There is necessary to define and select problems that can be addressed from the perspective of open innovation. To do so, using explicit language solution criteria should be done to avoid preconceived solutions (rejection of possible solutions). In addition, the formulation of these problems should allow people with different specialties to

recognize similarities between the current problem and past solutions that they had generated. On the other hand, if the project is too large, it is necessary to subdivide it into manageable elements in order to facilitate the search for solutions.

The capture of value coming from the open innovation initiatives will depend on the strengthening of the capacities of knowledge proposed by Lichtentaler and Lichtentaler [69], who propose an integrated structure for exploration, retention, and the exploitation of internal and external knowledge. Moreover, the existence of complementary goods such as distribution channels or manufacturing facilities that allow obtaining utility of technological innovation is also needed.

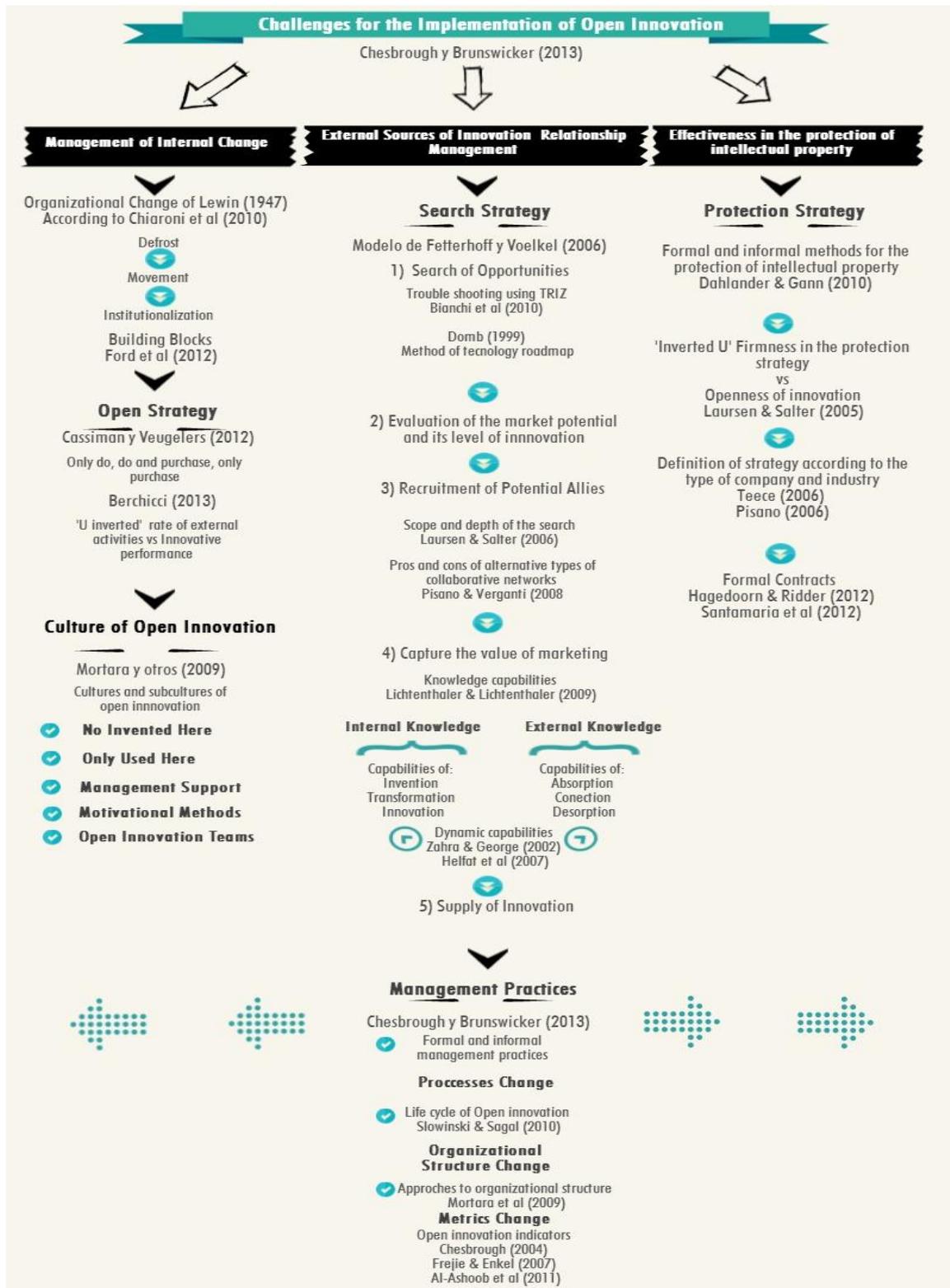
The definition of an appropriate strategy of intellectual property protection is necessary because the use of mechanisms of appropriation has a curvilinear relationship with the degree of openness of an organization to external resources. The relationship between openness and firmness in the strategy of intellectual property protection can be graphed in the form of 'inverted U'.

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APPENDIX A. MAPPING OF THE CHALLENGES FOR THE OPEN INNOVATION MODEL'S IMPLEMENTATION IN SERVICE SECTOR

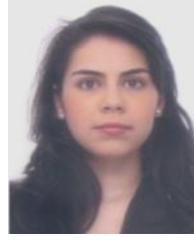




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