Universidad del Valle

Cuadernos de **Administración**
Journal of Management

VOL. 34
N° 61
May - Aug.
2018

Print ISSN: 0120-4645 / E-ISSN: 2256-5078 / Short name: cuad.adm. / Pages: 31-44
Facultad de Ciencias de la Administración / Universidad del Valle / Cali - Colombia

Innovation in Companies operating in the Foodstuffs Sector of Colombia. An analysis from the perspective of open innovation*

La innovación en las empresas del sector de alimentos en Colombia. Un análisis desde la perspectiva de la innovación abierta

L'innovation dans les entreprises du secteur alimentaire en Colombie. Une analyse du point de vue de l'innovation ouverte

Tulio Ferney Silva Castellanos[1]
Assistant Professor, Department of Management and Organizations, Faculty of Administrative Sciences, Universidad del Valle, Cali, Colombia. e-mail: tulio.silva@correounivalle.edu.co

Martha Lucia Agredo Díaz[2]
Master's Student in Public Policy, Department of Administration and Organizations, Faculty of Administrative Sciences, Universidad del Valle, Colombia. e-mail: martha.agredo@correounivalle.edu.co

Article of Scientific and Technological Research,
PUBLINDEX-COLCIENCIAS classification
Submitted: 12/12/2017
Reviewed: 26/03/2018
Accepted: 21/06/2018
Core topic: Administration and Organizations
JEL classification: 032, L66
DOI: 110.25100/cdea.v34i61.5922

Abstract

This study explores the characteristics of open innovation within the foodstuffs industry in Colombia, contrasting the importance recognized by its actors of this way of generating innovations with the spontaneous and incipient nature of the process, in a sector of vital importance for the economy and a valuable growth potential in line with the new dynamics and trends of the globalized world with highly demanding consumers in terms of health, well-being and improvement of quality of life and in a highly competitive environment (Traill and Meulenberg, 2002; Costa and Jongen, 2006; Trienekens and Zuurbier, 2008; Schiefer and Deiters, 2016). As a paradigm, open innovation is determined by the complex interaction of actors whose synergy projects the innovation system onto a given region. This context makes it essential to identify the main actors involved in the process and their form of interaction. By developing the proposed qualitative analysis exercise, the characteristics of the actors and their relationships in four production lines of the

* The results hereof were presented at the "1st"Encuentro Internacional de Innovación Aplicada a la Empresa (International Meeting on Innovation Applied to Business)" held in the city of Pasto and are part of a research project entitled *"Main characteristics of competitive performance in some sub-sectors of the foodstuffs industry of Colombia: the role of innovation in sectoral productive transformation"* developed by the International Negocios Internacionales y comercio Exterior (International Business and Foreign Trade) Research Group and the Marketing Research Group of the Universidad del Valle between 2009 and 2013.

1 Business Administrator, Universidad del Valle, Master of Science of the Organization, Universidad del Valle, Colombia. Research Group in International Business and Foreign Trade, Universidad del Valle, Colombia.

2 Economist, Foreign Trade Professional, Universidad del Valle, Colombia. Research Group in International Business and Foreign Trade, Universidad del Valle, Colombia.

foodstuffs sector in Colombia (the meat sector, the dairy sector, the milling sector and the confectionery sector) are investigated. These sub-sectors were selected according to their degree of participation in domestic production. Through in-depth interviews, some companies in the Colombian food sector fall under the initial stage of open innovation. Additionally, the results suggest that companies acknowledge the importance of developing strategies with external actors, oriented according to public policy guidelines on innovation in Colombia.

Keywords: Innovation, Open innovation, Foodstuffs industry, Low-technology industries, National Innovation System.

Resumen

Este estudio explora las características de la innovación abierta dentro de la industria de alimentos en Colombia, contrastando la importancia reconocida por parte de los actores de ésta forma de generar innovaciones, con el carácter espontáneo e incipiente del proceso, en un sector de vital importancia para la economía y con un valioso potencial de crecimiento acorde con las nuevas dinámicas y tendencias del mundo globalizado con consumidores altamente exigentes en términos de salud, bienestar y mejora de la calidad de vida y además en un entorno altamente competitivo (Traill and Meulenberg, 2002; Costa and Jongen, 2006; Trienekens and Zuurbier, 2008; Schiefer and Deiters, 2016). Como paradigma, la innovación abierta se determina a partir de la compleja interacción de actores por cuya sinergia se proyecta el sistema de innovación en una región determinada. Contexto que hace indispensable identificar los principales actores que participan en el proceso y su forma de interacción. A través del desarrollo del ejercicio de análisis propuesto, de tipo cualitativo, se indaga sobre las características de los actores y sus relaciones en cuatro renglones del sector de alimentos en Colombia (el sector cárnico, el sector lácteo, el sector de molinería y el sector de confitería). Estos subsectores se seleccionaron según su grado de participación en la producción nacional. A través de entrevistas en profundidad, se catalogaron algunas empresas del sector de alimentos colombiano, en la etapa inicial de innovación abierta. Adicionalmente, los resultados sugieren que las empresas reconocen la importancia de desarrollar estrategias con actores externos a la compañía, orientados de acuerdo a los lineamientos de política pública sobre innovación en Colombia.

Palabras clave: Innovación, Innovación abierta, Industria de alimentos, Industrias de baja tecnología, Sistema de Innovación Nacional.

Résumé

Cette étude explore les caractéristiques de l'innovation ouverte dans l'industrie alimentaire en Colombie, en opposant l'importance reconnue par les acteurs de cette manière de produire des innovations à la nature spontanée et naissante du processus, dans un secteur d'importance vitale pour l'économie et un potentiel précieux de croissance conforme aux nouvelles dynamiques et tendances de la mondialisation avec des consommateurs très exigeants en termes de santé, de bien-être et d'amélioration de la qualité de vie et dans un environnement hautement concurrentiel. (Traill et Meulenberg 2002, Costa et Jongen, 2006, Trienekens et Zuurbier, 2008, Schiefer et Deiters, 2016). En tant que paradigme, l'innovation ouverte est déterminée par l'interaction complexe des acteurs dont la synergie projette le système d'innovation dans une région donnée. Ce contexte rend indispensable l'identification des principaux acteurs impliqués dans le processus et leur forme d'interaction. A travers le développement de l'exercice d'analyse qualitative proposé, les caractéristiques des acteurs et leurs relations dans quatre lignes du secteur alimentaire en Colombie sont étudiées : (le secteur de la viande, le secteur laitier, le secteur de la minoterie et le secteur de confiserie). Ces sous-secteurs ont été sélectionnés en fonction de leur degré de participation à la production nationale. Grâce à des entretiens approfondis, certaines entreprises du secteur alimentaire colombien ont été cataloguées au stade initial de l'innovation ouverte. Par ailleurs, les résultats suggèrent que les entreprises reconnaissent l'importance de développer des stratégies avec des acteurs externes à l'entreprise, orientés conformément aux lignes directrices de politique publique sur l'innovation en Colombie.

Mots-clés: Innovation, Innovation ouverte, Industrie alimentaire, Industries de faible technologie, Système National d'Innovation.

1. Introduction

This paper's development focuses on the characterization of innovation in the foodstuffs industry from the perspective of open innovation through an empirical study of nine companies within four specific sectors: meat, dairy, milling and confectionery, selected on account of their economic importance and dynamics. The development of in-depth interviews helped to identify new perspectives on the progress of open innovation in Colombia; especially in a sector that shows evidence of interaction between actors, which at some level favor the process. Chesbrough (2006) defines open innovation as a distributed innovation process, based on both internal and external flows of knowledge intentionally managed across organizational boundaries to accelerate innovation processes in companies.

The first part presents the theoretical approach that guides the proposed work in a synthetic manner, and which has been the result of an extensive bibliographical review that, in turn, outlines a conceptual framework

for the research project entitled "Main characteristics of competitive performance in some sub-sectors in the foodstuffs industry of Colombia: the role of innovation in sectoral productive transformation", carried out by the International Business and Foreign Trade Research Group and the Marketing Research Group of the Universidad del Valle between 2009 and 2013. This exploration highlights the most relevant aspects of the concept of open innovation and the characterization of the actors and relationships at the business level that determine the synergies produced by this type of innovation. This exploration is complemented by a state of the art exploration on innovation in Colombia from a political perspective, in order to establish the framework that will serve to contrast what is proposed at this level and the trends on innovation management in the companies analyzed.

Subsequently, the findings are presented whose basis is the outcome of in-depth interviews conducted with innovation managers in the aforementioned companies, located in different geographical regions of Colombia. Among the obtained results stands out the establishment of relationships between actors within the companies and the flow of information generated to articulate strategies connected with the national policy of the country's Science, Technology and Innovation System.

However, a high intuitive content defines the relationships established, thereby setting up a typical contrast of incipient stages of an innovation system, in which knowledge-generating referents and followers spontaneously emerge, who appropriate it through empirical means, before finding more complex ways to generate their own values in terms of innovation.

Innovation Systems are based on the general theory of systems and contribute to generating interaction processes between different external and internal actors of companies to promote innovation (Perdomo, 2009). Governments have gradually adopted these innovation systems to build the institutional framework and design of Science, Technology and Innovation (STI) policies that companies themselves recognize and internalize in their operating strategies.

In this way it possible to assert that from a macroeconomic approach through innovation systems, government policies connect to the concept of open innovation. In recent years, this concept has begun a phase of implementation by companies through interaction with different actors, taking a valuable step from closed innovation models and business secrets to an open innovation model (De Jong, Vanhaverbeke, Kalvet and Chesbrough, 2008).

The development of the analysis contributes to two essential aspects in the field. In principle, it contributes to knowledge in the areas of innovation at low-tech industries. Moreover, in a complementary way, it contributes to the development of the open innovation concept in a sector with low technological content.

The foodstuffs sector is of great interest given the growing consumer demand associated with health, well-being and quality of life (Traill and Meulenberg, 2002; Trienekens and Zuurbier, 2008; Schiefer and Deiters, 2016). Moreover, in a context of globalization and high interconnection in markets, this paper gains relevance by analyzing how different actors interrelate to develop innovative processes of vital importance for business growth and development (Harris and Mowery, 1990; Hult, Hurley and Knight, 2004; Leiponen and Helfat, 2010).

2. Theoretical framework

2.1. Innovation in low-tech sectors

The foodstuffs industry is classified as a low-technology industry, wherein the type of developments are fundamentally incremental rather than disruptive innovations. Consequently, research on this sector has demonstrated the importance of the actors' interaction in this sector with their peers and with those in other sectors for the development of innovative attributes (Trott and Simms, 2017).

Based on Schumpeter's (1934) approaches, which posit a fundamental role for relations between economic development actors, and mainly entrepreneurs, to generate

creative ruptures in favor new businesses creation, the concept of open innovation alludes to creative synergies that foster business development and, consequently, economic development. Promoting this type of innovation allows organizations to better develop their internal projects and exploit external ideas in conjunction with market access routes (Martínez, 2013). Likewise, Sterns (2015) also argues that this type of industry has begun a process of opening up innovation to become more competitive. In turn, the work of Moskowitz and Saguy (2013) and Seyfettinoglu (2016) provides a factual basis for identifying the foodstuffs industry's consumer's knowledge and improving business performance, essential conditions to the principles of open innovation.

Although empirical evidence on open innovation strategies in the foodstuffs industry is still limited, some qualitative studies have highlighted how different companies have succeeded in overcoming some of the barriers to innovation (Bigliardi and Galati, 2013). Among them are the study by Thomke and Von Hippel (2002) describing the case of the company International Flavors Fragrances (IFF), Sarkar and Costa's (2008) describing the Procter & Gamble case (P&G) and the use of external sources for innovation and Vanhaverbeke and Cloodt's (2006) explaining how Calgene, a plant biotechnology firm, established a network of relationships with companies, consumers and legislators to access their complementary assets and to improve its levels of innovation.

Overall, these last three cases in the food industry show the impact of open innovation on the development of new products and, above all, how this form of innovation generates a radical and incremental novelty in the market for companies that it has directly influenced their degree of competitiveness (Sarkar and Costa, 2008). The cutting-edge knowledge needed for innovation tends to be found among different actors and groups of actors or environments (Rothaermel, Hitt and Jobe, 2006). To this end, industrial knowledge bases are actually fed by technological developments that are not only deployed within companies, but are accumulated through experience and interaction with other external actors such as customers or suppliers.

These interactions generate reference frameworks that arise spontaneously at first, but become nodes that evolve into paradigmatic innovation systems thereafter. To strengthen this idea, Cooke (2007) points out that there is a decreasing role in cumulative innovations within sectors and an increasing importance of recombining innovations between sectors, which leads to developing of new ideas and routes of operation from external knowledge sources. In addition, Hauknes and Knell (2009) argue that knowledge flows between actors can be materialized from machinery and components, and across industries or companies with different degrees and characteristics of development and technological intensity. In this vein, technology-intensive industries and scientific development interact with low-technology sectors (such as the food sector), providing them with machinery and equipment that allows them to grow and develop (Pavitt, 1984).

While it is true that companies in low-tech sectors invest in Research and Development, it is also true that they do so at a much lower percentage of their revenues compared to other high-tech industries (Trott and Simms, 2017). Frequently the results in productivity improvements for low-tech companies correspond to the use of technology offered by high-tech sectors. Said technology is applied within the production processes of companies, rather than incorporating the results of research processes developed at in-house research and development centers. Therefore, the knowledge-generating factor occurs in large companies, while it is disseminated through various mechanisms in low-tech industries.

Generally speaking, the dominant pattern characterizing low-tech industries is a high dependency on companies operating in other high-tech industries, leading to returns on investment resulting from the optimization of their processes with existing technologies on the market that lead to incremental innovations rather than disruptive innovations and high levels of risk (Bunduchi and Smart, 2010).

2.2. Open innovation

Innovation has been widely recognized in

the literature as one of the main elements determining the economic efficiency and performance of both companies and countries (Harris and Mowery, 1990; Hult *et al.*2004), as well as the levels of adaptation and survival of companies exposed to different increasingly dynamic and competitive environments (Damanpour, Walker and Avellaneda, 2009). This dynamism, linked to the process of globalization that has become increasingly intensive, requires companies to not only trust in the development of their ideas internally, as it also demands for the use of external sources of information and knowledge, which could improve enterprises' chances of succeeding (Leiponen and Helfat, 2010).

For Chesbrough (2006), open innovation is the antithesis of the traditional model of vertical integration where internal R&D activities lead to the successful development of products that can later be commercialized by the company. Thence, open innovation assumes that companies can, and should, use both ideas and external and internal paths in order to configure architectures and systems that facilitate the creation of value. Therefore, the differentiating points of open innovation in relation to previous theories of innovation lie in the fact that the same level of importance is assigned to both internal and external knowledge.

The open innovation model focuses on the creation of commercial value with a significant growth in the number of actors contributing to innovation. From this perspective, companies can participate in inbound open innovation activities (strengthening their skills and knowledge from relationships with suppliers, customers or other actors in the internal innovation process (Enkel, Gassmann and Chesbrough, 2009), as well as in outbound open innovation activities (e.g. technology licensing, which represent gains to the extent that they enable ideas, patents and other forms of intellectual property rights to be brought to market) (Lichtenthaler and Ernst, 2007).

On the other hand, companies can also carry out more comprehensive open innovation processes that simultaneously include both inbound and outbound open innovation activities, through co-creation (Enkel *et al.* 2009). This orientation allows companies to establish close ties with their customers and suppliers, thus generating direct communication channels to learn how their perception of these can lead to innovation. Recently, the concept of open innovation has transcended and led to the inclusion of multiple actors, because for innovation processes to be sustainable, they must be from everyone and for everyone (Chesbrough, 2017).

Thus, open innovation has been built on the basis of a world of widespread knowledge wherein companies cannot and should not rely entirely on their own research results, but should leverage external sources of knowledge, buying or licensing processes or inventions and commercializing their knowledge, in order to solve a problem (Traitler and Saguy, 2009).

Finally, Bogers, Zobel, Afuah, Almirall, Brunswicker, Dahlander, Frederiksen, Gawer, Gruber, Haefliger, Hagedoorn, Hilgers, Laursen, Magnusson, Majchrzak, McCarthy, Moeslein, Nambisan, Piller, Radziwon, Rossi-Lamastra, Sims and Ter Wal, (2017) emphasize the importance of analyzing open innovation at different levels, since this concept has implications not only at individual and business levels, but also at industry level as is the case of the food industry. In this case, the current dynamics have led companies to migrate from a traditional approach to food to the development of new functional products aimed at new markets, with an approach of exploration and adoption of open innovation, with multiple and diverse interactions of actors and creation of endogenous and exogenous knowledge to develop unique competencies at the global level (Khan, Grigor, Winger and Win, 2013).

2.2.1. Open innovation in the foodstuffs industry

In the food industry, the concept of open innovation has been considered of great interest and high impact because this sector has been characterized as conservative in terms of the type of innovations introduced to the market (Bigliardi and Galati, 2013). In the last two decades, food companies have been motivated to migrate to more lucrative markets with higher return potential,

thereby moving from conventional products to the development of new functional and healthy products and the implementation of new technology usage techniques in the different stages of the value chain, from raw material producers to companies in charge of processing (Díaz, 2012; Govindan, 2018). In such markets, innovation dynamics require more open processes with a more inclusive approach that includes cooperation networks, external sources of knowledge and adoption of technologies as suggested by open innovation (Khan *et al.* 2013; Pineda, 2015).

The literature review has highlighted different approaches to this sort of innovation in terms of organizational forms, acquisition or commercialization of technology and knowledge, and different levels of integration (García Martínez, Lazzarotti, Manzini and Sánchez García, 2014). Some approaches have highlighted, for instance, the number and type of participants in open innovation within an industry (Laursen and Salter, 2014), the direction of opening that may be outgoing or incoming (Lichtenthaler and Ernst, 2007) or even the factors that facilitate the adoption of technologies (Pierpaoli, Carli, Pignatti and Canavari, 2013).

According to Costa and Jongen (2006), the global nature of companies in the food industry and the rapid change in food preferences, consumption habits and demand, as well as the transformations in the supply chain, have led to innovation becoming a strategic axis for the development and profitability of the industry, rather than an option for minimizing production costs.

In this sense, Moskowitz and Saguy (2013) argue that in order to survive and thrive in a globalized environment, companies must seek strategies to search for external knowledge, based on compatible differences, using open innovation models, wherefrom the entire value chain of the industry becomes aligned around the proposed innovation objectives.

Increasing globalization and population growth have led to analyzing the impact of sustainability on value chains, especially in the food industry, given the complexity of coordination among the different members (Govindan, 2018). According to Bigliardi and Galati (2013), the literature suggests that there are three main models that have been applied to further the adoption of the open innovation concept in this type of industry.

The first of these models, known as "Sharing is Winning", is a model wherein open innovation is taken as a co-creation process which harnesses technologies and the expertise of researchers around the world, including scientific universities, venture capital, strategic suppliers and laboratories, through three main stages: firstly, establishing a relationship of trust. Secondly, having the willingness to match the wishes and needs of the parties and finally, as a result, reaching the value creation that is the ultimate goal of any relationship in such a model (Traitler and Saguy, 2009).

In the second model, "The food-machinery framework", proposed by Bigliardi, Bottani and Galati (2010), the concept of open innovation in the food industry, is analyzed from three main actors, namely, machinery suppliers, machinery manufacturers and customers of machinery, i.e., companies in the foodstuffs sector. The results of this study suggest that the actors that most adopt the new open innovation paradigm are machine manufacturers, who play the key role in this model. Notwithstanding, the food companies that become customers of the machinery companies are also actors that implicitly adopt the concept of open innovation in the development of their activities through their suppliers, additionally relying on multiple partners such as universities and research centers.

The latest model developed by Slowinski (2004), described as "Want, Find, Get, Manage", posits that companies pursue an open innovation effort through a life cycle that begins with the question or need for knowledge to be acquired externally, subsequently identifying the partner for innovation, then setting up an agreement and finally coordinating and executing the agreement, thence ensuring a correct understanding of what the parties desire. This model considers that the type of partners is given according to the needs that the companies identified in the first phase of the process, and in this sense the collaboration can arise with a wide number of actors that might include clients or consumers, industrial partners (large companies and SMEs), universities and research centers, laboratories, competitors,

companies operating in other industries and others that contribute to the creation of value (Bigliardi and Galati, 2013).

Recently, great efforts have also been focused on the so-called "green" or sustainability practices in the value management chains of the foodstuffs sector (Li, *et al.* 2014), where different actors need to coordinating as they contribute their points of view to optimize processes in order to achieve better results (Govindan, 2018).

2.3. Open Innovation and Innovation System in Colombia

Open innovation refers to a concept discussed at the corporate level that parallel innovation policies have approached based on the theory of systems, which postulates that government policies should be aligned with the behavior of companies and that to this extent different actors should lead companies to develop open innovation activities (De Jong *et al.* 2008). Thus, both the concept of open innovation and the theory of systems and the national innovation system are amply related, even though, as De Jong *et al.* (2008) points out, open innovation focuses on what companies do, while the literature on systems focuses on analyzing industries and countries at the macroeconomic level.

Edquist (1997) defines an innovation system as "all the important economic, social, political, organizational, institutional and other factors influencing the development, diffusion and use of innovations". A key distinction between open innovation and innovation systems is that the former has been identified from a managerial perspective and has thus far been studied mainly at the organizational level (Chesbrough, Vanhaverbeke and West, 2006), whereas the literature on systems has been developed in an economic and industrial context (OECD, 2008), leading to the conclusion that open innovation at the company level pertains to other actors in society who are part of the innovation system (Wang, Roijakkers and Vanhaverbeke, 2011). In addition, according to De Oliveira, Echeveste, Cortimiglia and Gonçalves (2017), innovation systems are potentially favorable environments for the implementation of open innovation practices.

The literature on systems reckons innovation as a social process with multiple interactions among different parties, where innovations are the result of development and learning processes across organizational boundaries and arise from interaction with other sources of knowledge (Lundvall, 1992). While the literature on innovation systems considers companies as black boxes, the Open Innovation model opens these boxes and reveals what is inside (De Jong *et al.* 2008).

In Colombia, the National Innovation System (SNI per its acronym in Spanish) finds its origins around the 1940s with the science and technology policy that has been evolving slowly but progressively up to its formal establishment as the SNI in 1995 after the guidelines of Act 29 of 1990 (Gómez & Álvarez, 2012; Ruano, Echeverri, Rodríguez, Castellanos and Pineda, 2016). Nowadays, this system is defined as an open, non-exclusive system that includes all programs, strategies and activities in science, technology and innovation, regardless of the public or private institution or person that develops it.

Through COLCIENCIAS, the entity in charge of public policies on science, technology and innovation, the government strives for the articulation of different actors, including academia, government institutions and the business sector, to achieve economic and social development based on innovation that contemplates multiple actors, including companies that make open innovation. In this way, the importance of exploring the concept of open innovation is perceived, which is not only relevant at the enterprise level, but also relates to policy aspects such as innovation systems.

3. Methodology

The economic activity in Colombia is grouped in nine important branches, within which the manufacturing industry stands out, wherein lies the goods that reach the final consumer and whereto the food sector belongs. Since 2000, this industry has had an average share of 13% of total GDP and employs 11.7% of the 22.0 million people employed in the national total for the moving

quarter from December 2017 to February 2018. As for exports, the manufacturing industry has had an average share of 46% of Colombia's total exports since 2000.

This paper focuses particularly on four of the most representative and competitive sectors of the manufacturing industry in Colombia, which have been chosen in terms of greater dynamism with respect to macroeconomic indicators in the period analyzed in the project "Main characteristics of competitive performance in some sub-sectors in the foodstuffs industry of Colombia: the role of innovation in sectoral productive transformation", i.e., the meat sector, the dairy sector, the milling sector and the confectionery sector, which since 2000 had a share of 2.3%, 1.8%, 5.7% and 4.7%. With regard to employment, the meat sector contributes 4.8% of total employment in the manufacturing industry, the dairy sector with 3.5%, the milling sector with 1.5% and the confectionery sector with 1.2%. Lastly, food products account for 21% of total industrial exports.

Now, this study is qualitative and corresponds to an applied case analysis based on semi-structured interviews conducted in 2011 with managers or persons in charge of the innovation or marketing area of different companies within the foodstuffs industry in the four previously specified sectors and in different regions of the country selected in terms of sales and assets registered through a guided search in the Benchmark database. In accordance with the ease of access to information, a purposive sample of nine large companies was obtained, given that this type of companies become a point of reference for MSMEs. These companies belong to the main cities of the country, namely, Cali, Medellín and Bogotá, of the aforementioned nine (9) companies, while four (4) belong to the meat sector, two (2) to the dairy sector, two (2) to the milling sector and one (1) to the confectionery sector. The case studies illustrated from in-depth interviews turn out to be an appropriate instrument, bearing in mind that in Colombia there are no previous studies that support or indicate the presence of open innovation in the food industry in the country, and therefore this type of studies enable the first approach to this issue.

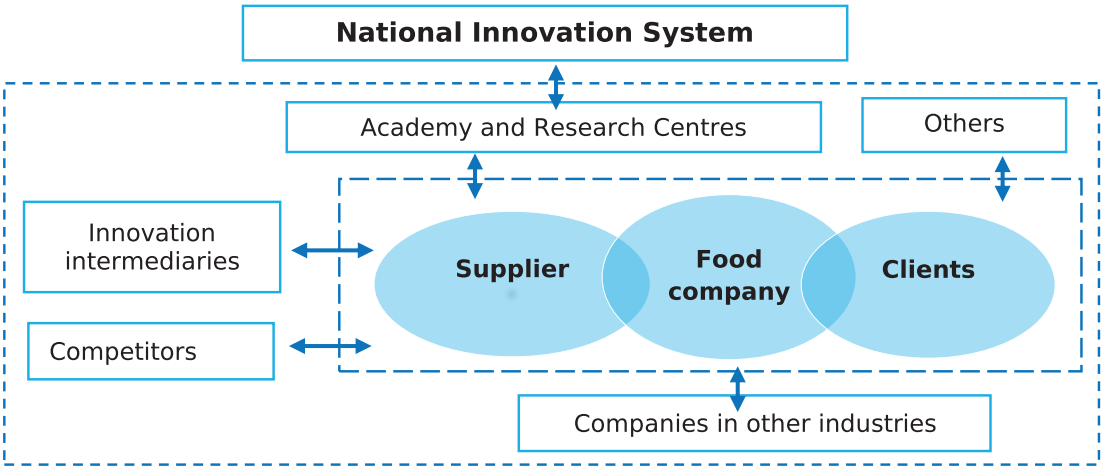
Based on the review of the literature, and in accordance with the review of the models and constructs used in the definition of open innovation both at a general level and in the models studied in the food sector (Bigliardi and Galati, 2013), the main actors that were most frequently repeated in the literature and were part of this process were identified and classified. Bearing this in mind, the answers provided by the interviewed companies were explored up to building up analytical categories of actors which enabled to detail the way in which these participated in the processes of innovation at the companies performing in the aforementioned sectors, thus providing a better understanding as to how the open innovation concept is applied in the foodstuffs industry of Colombia.

It should be noted that in Colombia the concept of open innovation is relatively new and has been addressed in national policy programs as a system of business innovation (COLCIENCIAS, 2017), which is currently framed within the national Innovation System, still under construction and improvement. This system seeks to ensure the integration of the different actors in an articulated manner so that innovation becomes an essential factor that promotes competitiveness and growth for both the companies and the country, given that the main problem identified in Colombia is the country and its regions not having managed to promote economic and social development through science, technology and innovation (DNP, 2015). Figure 1 describes the main actors identified in an open innovation model for the food industry, which this study analyzed.

4. Results and discussion

The findings suggest that the food industry in Colombia is currently undergoing a nascent process of open innovation, in which it has not yet been possible to achieve a complete articulation of the actors proposed in the theoretical model poised within the National Innovation System. Based on the conducted interviews, it was not possible to corroborate the existence of links between the actors formalized through contracts, as required for this type of innovation to be effective and

Figure 1: Open innovation model for the foodstuffs industry



Source: Adapted from Bigliardi & Galati (2013).

comply with the proposed results (Traitler and Saguy, 2009). This is consistent with one of the main problems encountered by the national government in terms of innovation, wherefrom the challenge of empowering different actors such as entrepreneurs, academics and the State in the participation, design and execution of policies or models that lead to innovation results is undertaken (DNP, 2015).

As a result of the nine companies analyzed, whose innovation managers in each of the sub-sectors mentioned above were interviewed in depth, it is evident how the companies liaise to different actors, where suppliers, customers, academia, research centers, government entities stand out and companies in other industries to a lesser extent. The dairy and milling sectors stand out, where the existence of intermediaries in knowledge management was identified, which facilitate the development of activities and methodologies for the promotion and development of innovation by companies.

Specifically, in the case studies of the meat sector, it was found that as for these companies the relationship with customers is very important due to their perception of the products. As Troy and Kerry (2010) point out, the profitability of these companies depends on this relationship. These authors also pointed out the importance of the clients and their perception of the products' safety and quality in aspects such as the color of the meat, the dripping or visible fat are elements that permit to identify expectations and adapt the products according to the tastes by designing new strategies within the organizations.

With regard to suppliers, which are generally companies in other industries, they were found to play an important role in the provision of machinery and technology management even when the relationships are not permanent but according to specific needs that in many cases are oriented to mechanisms for payment compliance. In this sector, the relationship with academia and research centers has been rather weak and has supported basic aspects such as trade strategies, even though the interviewed companies express constant requirements for packaging materials, nutritional composition, chemical developments, among others, where this type of relationship could be very beneficial.

Finally, the companies in the meat sector expressed knowledge of the National Innovation System and despite having developed some strategic alliances, up to the time of the interviews they had not executed or developed specific projects to materialize actions that lead to innovation. The companies in this sector also indicated

that they had some strategies for the use of waste and scrap from their production, although not formalized.

In the dairy sector, the two companies interviewed agreed that the relationship with suppliers is vital inasmuch as allows them to generate feedback processes when performing research and development (R&D) activities and this link also allows them to carry out consultancy services that lead to an improvement in the quality of raw materials, which stem from the same research and development activities.

The resulting situation consists in the perception that the dairy sector is currently facing a wide variety of challenges pertaining to health and welfare, environmental protection and market liberalization, which challenges companies to be ever more innovative and to liaise to other industries in essential aspects such as the packaging for the conservation of products.

With regard to customers, the companies in the dairy sector expressed having communication mechanisms with them, mainly through their distribution centers from which the highest levels of demand were known. Likewise, at the sales centers, they also use mechanisms such as offering tastings where customers are given the chance to present their opinions, which leads to improvements in the research, development and ideation processes for future innovations.

On the other hand, the studies developed by academia they use as a source of information on health, nutrition and wellbeing issues in the long term, although companies state that this approach is more academic than practical.

With respect to innovation intermediaries, companies manifested relying on companies that offer support in the implementation of collaborative work methodologies such as the stage-gate, which guide and direct innovation processes. Finally, the companies pronounced their participation in Science, Technology and Innovation projects, basically with COLCIENCIAS, the entity in charge of innovation in Colombia on which they have a good level of confidence. Through this entity, they have competed for resources, benefits and recognition to be classified as companies that COLCIENCIAS calls “highly innovative”.

In the milling sector, the quality of the products was found to be very important for the two companies interviewed, and in this vein, they stressed their concern for having good relationships with suppliers so that they can explain their needs and accompany and guide them according to their demands and the demands of the market.

With respect to clients, the interviewed companies attested to their importance and the need to know their demands closely through instruments such as focus groups, surveys, market research and other qualitative techniques that allow companies to know and predict the tastes and preferences of customers.

The relationship with companies in other industries is basically oriented to merely acquiring machinery, which is done through placing orders in a timely manner without establishing long-term commitments or close relationships. Regarding academia, the interviewed companies mentioned that they liaise through the launching of business challenges for students in the form of a call in which the best solutions are competed for and rewarding the best proposals.

As in the dairy sector, there was evidence of support by innovation intermediaries through the implementation of collaborative work methodologies such as state-gate. Within the framework of the National Innovation System, the companies interviewed voiced their strategic alliances with INNPULSA, which is known in Colombia as the business growth management unit of the National Government, created in February 2012 to promote entrepreneurship, innovation and productivity as the cornerstones for the country’s business development and competitiveness.

According to the companies interviewed, these alliances were established in order to receive consultancy services on innovation culture, the development of skills to incorporate this culture into companies, the structuring of projects and innovation proposals that can be financed with other resources.

The confectionery sector highlights the importance of a close relationship with the supplier of both raw materials and technologies, as it facilitates the monitoring and optimization of resources in terms of both costs and quality. As in the other sectors under analysis, the client has a very valuable role to play, and in this sense, the companies' products are adapted according to their tastes and needs according to the different regions or even countries that can be reached.

Furthermore, the application of co-creation-with the-client collaborative work methodologies stands out as well, especially in the development of new products. The research within the academy and research centers are a reference point for the development of new products and new categories, according to the company interviewed.

Finally, the company pointed out the relevance of the strategic alliances fostered by COLCIENCIAS, which poises the strengthening of the National Innovation System is proposed, among other aspects, and that according to the company's statements offers resources and calls for the implementation of business innovation initiatives in this sector.

While it is true that in all the sub-sectors subject of the study the companies manifested some type of relationship between food companies and other actors (suppliers, clients, companies operating in other industries, academia and research centers), the creation of networks with competitors in their innovation processes was not identified, which may be associated, among other factors, to the lack of an associativity culture that generally characterizes companies in Colombia (Vega, 2012).

Regarding innovation intermediaries, the case studies suggest that, in both the dairy and milling sectors, companies find support in collaborative work methodologies (state-gate) offered by expert organizations through the accompaniment and advice on innovation and business development issues through strategic projects.

Lastly, all the interviewed companies mentioned having established alliances or at least having knowledge of any governmental organization that promotes innovation activities through calls for proposals or activities for the consignment of resources, all of this within the framework of the National Innovation System.

Notwithstanding, it is worth noting that fully articulated work is lacking, one in which all actors work together to achieve specific objectives and better results (Leiponen and Helfat, 2010), and despite the fact that they work with a large number of actors, the depth of each relationship is limited, which prevents innovation from having a greater impact (Laursen and Salter, 2014).

The development of the study shows that companies participate in innovation processes with some of the previously identified actors, but do not specify formal documents or baselines that allow them to validate and measure efforts and results explicitly in terms of innovation, which shows an intuitive and incipient basis in their innovation strategies.

5. Conclusions

The process of globalization that taken place around the world has forced not only companies but also governments to review their strategies in order to improve competitiveness and success in their results. Companies therefore require different actors and suitable environments to implement innovations into their processes (De Jong *et al.* 2008).

In this sense, earlier studies have indicated that the foodstuffs industry connects through the value chain with different actors such as suppliers, customers, competitors, companies operating in other industries, universities and research centers (Bigliardi and Galati, 2013).

This type of relationship along global value chains is essential to strengthen food security and guarantee quality and efficiency in processes (Pignatti, Carli and Canavari, 2015). The results suggest that there are indeed different actors involved in the innovation process, but not all of them are articulated in the same way and to the same extent in the different sectors studied.

For instance, only companies in the dairy sector reported having a closer relationship with suppliers of raw materials, providing consultancy services, training and other services to guarantee the qulity thereof.

The results also indicate that companies in the Colombian food industry recognize the importance of strategic alliances with the government and public entities, precisely those at the forefront of the main activities and guidelines of the national science, technology and innovation system (CTeI).

In this system, through Colciencias, the entity in charge of the public policies of Science, Technology and Innovation in the country, the government tries to articulate different actors that contemplate academia, government and the business sector. Nonetheless, despite these efforts, none of the interviewed companies attested to having formal documents or a specific area or department for innovation, but that activities of this type were in most cases pertained to the marketing area.

In Colombia, the National Innovation System is precisely the framework wherefrom open innovation strategies for businesses should be developed and aligned with the organizational and economic structures of the countries, establishing areas and people specialized in the subject.

According to Saguy and Sirotinskaya (2014), significant change requires knowledge in harnessing external information sources and that all participants in the open innovation ecosystem assume a proactive role in what is known as the "fourth helix" where universities, industry, government and the private sector strongly support the sustainability of innovation. In this sense, the concept of open innovation and its respective business innovation models requires strengthening and articulating into the dynamics and guidelines of national innovation systems, given that both are built on the recognition of different relationships between organizations and institutions that are really critical both for business development and for the economic growth of countries (Herstad, Bloch, Ebersberger and Van De Velde, 2010).

Finally, for the development of future studies it is proposed for them to address open innovation for the theory of Networks standpoint. The open innovation models initially analyzed from the point of view of the company (Chesbrough, 2017), should be aligned in a more concerted manner with the National Innovation Systems that could in turn be interconnected with other systems at the international level, making it possible to create knowledge nodes on a global scale.

6. References

Bigliardi, B., & Galati, F. (2013). Models of adoption of open innovation within the food industry. *Trends in Food Science & Technology*, *30*(1), 16-26. doi:10.1016/j.tifs.2012.11.001.

Bigliardi, B., Bottani, E., & Galati, F. (2010). Open innovation and supply chain management in food machinery supply chain: a case study. *International Journal of Engineering, Science and Technology*, *2*(6), 16-26.

Bogers, M., Zobel, A. K., Afuah, A., Almirall, E., Brunswicker, S., Dahlander, L., ... Frederiksen, L. (2017). The open innovation research landscape: Established perspectives and emerging themes across different levels of analysis. *Industry and Innovation*, *24*(1), 8-40. doi:10.1080/13662716.2016.1240068.00000

Bunduchi, R., & Smart, A. U. (2010). Process innovation costs in supply networks: a synthesis. *International Journal of Management Reviews*, *12*(4), 365-383. doi: 10.1111/j.1468-2370.2009.00269.x.

Cooke, P. (2007). To construct regional advantage from innovation systems first build policy platforms. *European planning studies*, *15*(2), 179-194. doi: 10.1080/09654310601078671.

Costa, A. I., & Jongen, W. M. F. (2006). New insights into consumer-led food product development. *Trends in Food Science & Technology*, *17*(8), 457-465. doi: 10.1016/j.tifs.2006.02.003.

Chesbrough, H. (2006). Open innovation: a new paradigm for understanding industrial innovation. In H. Chesbrough, W. Vanhaverbeke & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 1-19). Boston, USA: Oxford University Press.

COLCIENCIAS. (2017). *Sistemas de Innovación.* Bogotá, Colombia: COLCIENCIAS.

Chesbrough, H. (2017). The Future of Open

Innovation. *Research-Technology Management*, *60*(1), 35-38. doi: org/10.1080/08956308.2017.1373048.

De Jong, J. P., Vanhaverbeke, W., Kalvet, T., & Chesbrough, H. (2008). *Policies for open innovation: Theory, framework and cases*. Helsinki, Finland: Tarmo Kalvet.

De Oliveira, L. S., Echeveste, M. E. S., Cortimiglia, M. N., & Gonçalves, C. G. C. (2017). Analysis of determinants for Open Innovation implementation in Regional Innovation Systems. *RAI Revista de Administração e Inovação, 14*(2), 119-129.

DNP. (2015). Política Nacional de Ciencia, Tecnología e Innovación 2015 – 2025. Bogotá, Colombia: CONPES.

Damanpour, F., Walker, R. M., & Avellaneda, C. N. (2009). Combinative effects of innovation types and organizational performance: A longitudinal study of service organizations. *Journal of management studies*, *46*(4), 650-675. doi: org/10.1111/j.1467-6486.2008.00814.x.

Díaz, A. J. R. (2012). Transferring knowledge in Quebec–Mexico partnerships: the case of the dairy industry. *The Journal of Technology Transfer*, *37*(5), 631-647.

Edquist, C. (Ed.). (1997). *Systems of innovation: technologies, institutions, and organizations*. London, uk: Psychology Press.

Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: exploring the phenomenon. *R&d Management*, *39*(4), 311-316.

García Martínez, M., Lazzarotti, V., Manzini, R., & Sánchez García, M. (2014). Open innovation strategies in the food and drink industry: determinants and impact on innovation performance. *International Journal of Technology Management 23*, *66*(2-3), 212-242.

Gómez, A. F. O., & Álvarez, C. A. A. (2012). El sistema de innovación colombiano: fundamentos, dinámicas y avatares. *Trilogía Ciencia Tecnología Sociedad*, (6), 105-120.

Govindan, K. (2018). Sustainable consumption and production in the food supply chain: A conceptual framework. *International Journal of Production Economics*, *195*, 419-431. doi:10.1016/j.ijpe.2017.03.003.

Hauknes, J., & Knell, M. (2009). Embodied knowledge and sectoral linkages: An input–output approach to the interaction of high-and low-tech industries. *Research Policy*, *38*(3), 459-469. doi: 10.1016/j.respol.2008.10.012.

Harris, R. G., & Mowery, D. C. (1990). Strategies for innovation: An overview. *California Management Review*, *32*(3), 7-16.

Hult, G. T., Hurley, R. F., Knight, G. A., 2004. Innovativeness: Its antecedents on business performance. *Industrial Marketing Management, 33*(5), 429–438. doi: 10.1016/j.indmarman.2003.08.015.

Herstad, S. J., Bloch, C., Ebersberger, B., & Van De Velde, E. (2010). National innovation policy and global open innovation: exploring balances, tradeoffs and complementarities. *Science and Public Policy*, *37*(2), 113.

Khan, R. S., Grigor, J., Winger, R., & Win, A. (2013). Functional food product development–Opportunities and challenges for food manufacturers. *Trends in food science & technology*, *30*(1), 27-37. doi: 10.1016/j.tifs.2012.11.004.

Laursen, K., & Salter, A. J. (2014). The paradox of openness: Appropriability, external search and collaboration. *Research Policy*, *43*(5), 867-878. doi: 10.1016/j.respol.2013.10.004.

Lichtenthaler, U., & Ernst, H. (2007). External technology commercialization in large firms: results of a quantitative benchmarking study. *r&d Management*, *37*(5), 383-397. doi:10.1111/j.1467-9310.2007.00487.x.

Leiponen, A., & Helfat, C. E. (2010). Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic Management Journal*, *31*(2), 224-236.

Li, D., Wang, X., Chan, H. K., & Manzini, R. (2014). Sustainable food supply chain management. *International Journal of Production Economics*, *152*(0), 1-8. doi:10.1016/j.ijpe.2014.04.003.

Lundvall, B. A. (1992). *National innovation system: towards a theory of innovation and interactive learning.* London, UK: Pinter

Martínez, M. G. (Ed.). (2013). *Open innovation in the food and beverage industry*. Cambridge, UK: Elsevier.

Moskowitz, H. R., & Saguy, I. S. (2013). Reinventing the role of consumer research in today's open innovation ecosystem. *Critical reviews in food science and nutrition*, *53*(7), 682-693. doi:10.1080/10408398.2010.538093.

OECD. (2008). Globalization and Open Innovation, OECD: Paris.

Pavitt, K. (1984). Sectoral patterns of technical change: towards a taxonomy and a theory. *Research Policy*, *13*(6), 343-373.

Perdomo Charry, G. (2009). ¿Por qué, cómo y para qué estudiar los Sistemas Nacionales de Innovación y Estilos de Innovación en Colombia? *Pensamiento & Gestión*, (27).

Pierpaoli, E., Carli, G., Pignatti, E., & Canavari, M. (2013). Drivers of precision agriculture technologies adoption: A literature review. *Procedia Technology, 8,* 61-69. doi: 10.1016/j.protcy.2013.11.010.

Pignatti, E., Carli, G., & Canavari, M. (2015). What really matters? A qualitative analysis on the adoption of innovations in agriculture. *Agrárinformatika/Journal of Agricultural Informatics*, *6*(4), 73-84.

Pineda Ospina, D. L. (2015). Análisis bibliométrico para la identificación de factores de innovación en la industria alimenticia. *AD-minister*, (27). doi: 10.17230/ad-minister.27.5.

Rothaermel, F. T., Hitt, M. A., & Jobe, L. A. (2006). Balancing vertical integration and strategic outsourcing: effects on product portfolio, product success, and firm performance. *Strategic Management Journal*, *27*(11), 1033-1056. doi:10.1002/smj.559.

Ruano, L., Echeverri, R., Rodríguez, H. A., Castellanos, T., & Pineda, D. (2016). Política Pública para la promoción de la Innovación del Sector Alimentos en Colombia. *Cuadernos de Administración (Universidad del Valle)*, *32*(56), 100-114.

Saguy, I. S., & Sirotinskaya, V. (2014). Challenges in exploiting open innovation's full potential in the food industry with a focus on small and medium enterprises (SMEs). *Trends in Food Science & Technology*, *38*(2), 136-148. doi:10.1016/j.tifs.2014.05.006.

Sarkar, S., & Costa, A. I. (2008). Dynamics of open innovation in the food industry. *Trends in Food Science & Technology*, *19*(11), 574-580. doi:10.1016/j.tifs.2008.09.006.

Seyfettinoglu, U. K. (2016). Analysis of relationships between firm performance and open innovation strategies and stages in the Turkish food and beverage industry. *New Medit, 15*(1), 42-53.

Schiefer, G., & Deiters, J. (2016). Food innovation dynamics and network support. In C. M. Galanakis (Ed.), *Innovation Strategies in the Food Industry* (pp. 1-17). London, UK: ELSEVIER. doi:10.1016/B978-0-12-803751-5.00001-5.

Schumpeter, J. A. (1934). *The Theory of Economic Development*. Cambridge, USA: Ediciones de la Universidad de Harvard.

Slowinski, G. (2004). *Reinventing corporate growth.* Gladstone, USA: Alliance Management Press.

Sterns, J. (2015). Open Innovation in the Food and Beverage Industry. *American Journal of Agricultural Economics*, *97*(5), 1515–1517. doi:10.1093/ajae/aav002.

Traitler, H., & Saguy, L. S. (2009). Creating successful: innovation partnerships. *Food technology*, *63*(3), 22-35.

Traill, W. B., & Meulenberg, M. (2002). Innovation in the food industry. *Agribusiness*, *18*(1), 1-21. doi: 10.1002/agr.10002.

Trienekens, J., & Zuurbier, P. (2008). Quality and safety standards in the food industry, developments and challenges. *International Journal of Production Economics*, *113*(1), 107-122. doi:10.1016/j.ijpe.2007.02.050.

Thomke, S., & Von Hippel, E. (2002). Customers as innovators: a new way to create value. *Harvard business review*, *80*(4), 74-85.

Trott, P., & Simms, C. (2017). An examination of product innovation in low-and medium-technology industries: Cases from the UK packaged food sector. *Research Policy, 46*(3), 605-623. doi: 10.1016/j.respol.2017.01.007.

Troy, D. J., & Kerry, J. P. (2010). Consumer perception and the role of science in the meat industry. *Meat science*, *86*(1), 214-226. doi:10.1016/j.meatsci.2010.05.009.

Vanhaverbeke, W., & Cloodt, M. (2006). Open innovation in value networks. *Open innovation: Researching a new paradigm*, 258-281.

Vega Rodríguez, R. A. (2012). *Pymes: reflexiones para la pequeña y mediana empresa en Colombia*.

Wang, Y., Roijakkers, N., & Vanhaverbeke, W. (2011). Linking open innovation to national systems of innovation: a coevolutionary perspective. *International Journal of Innovation and Regional Development*, *3*(5), 446-464.

¿How to quote this article?

Silva Castellanos, T. F., & Agredo Díaz, M. L. (2018). Innovation in Companies operating in the Foodstuffs Sector of Colombia. An analysis from the perspective of open innovation. *Cuadernos de Administración*, *34*(61), 31-44. DOI: 110.25100/cdea.v34i61.5922.

Cuadernos de Administración journal by Universidad del Valle is under licence Creative Commons Reconocimiento-NoComercial-SinObrasDerivadas 4.0. Based in http://cuadernosdeadministracion.univalle.edu.co/