

# Analysis of the state of the art of open innovation: Practical implications in engineering

## Análisis al estado del arte de la innovación abierta: Implicaciones prácticas en la ingeniería

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### Abstract

*The article aims to describe, identify and classify application forms for Open Innovation, delivering specific cases for its justification. The methodology consisted of a critical review of the main theoretical fundamentals presented in the statement about art, the concept of Open Innovation, its evolution and application. The concept of Open Innovation and its implementation is a matter that occurs in practice, where methodologies have not been determined to define the application mechanism that best suits the organization. The document has four sections. The first discusses the evolution of the concept of Open Innovation. The second classifies this concept, a continuation in the third se disponen los campos de aplicación específicos y sus principales mecanismos o herramientas de aplicación, ejemplos de aplicación y al finalizar en la última se entregan las conclusiones y aportes sobre posibles futuros estudios.*

*Keywords: Innovation, innovation management, open innovation, application of open innovation*

### Resumen

El artículo tiene por objetivo, definir el estado del arte de la Innovación Abierta (IA) mostrando su aplicación en un caso concreto. La metodología utilizada consistió en una revisión crítica de los principales fundamentos teóricos presentados en el punto estado del arte, del concepto de IA, su evolución y aplicación. El concepto de IA y su aplicación es una materia que se da en la práctica, donde no se han determinado las metodologías que permitan decidir el mecanismo de aplicación que mejor se adapte a la organización. El documento posee cuatro secciones. La primera discute la evolución del concepto de IA. La segunda clasifica este concepto, a continuación en la tercera se disponen los campos de aplicación específicos y sus principales mecanismos o herramientas de aplicación, ejemplos de aplicación y al finalizar en la última se entregan las conclusiones y aportes sobre posibles futuros estudios.

**Palabras clave:** Innovación, Gestión de Innovación, Innovación Abierta, Aplicación de Innovación Abierta

## 1. Introduction

*The application of the concept of innovation has evolved from an initial theory that gave emphasis to a closed innovation, where a linear process of innovation is highlighted with high investments in the research and development processes, evolving into what can be referred to as Open Innovation, which generates different degrees of receptivity of organizations, increasing or decreasing the flow of input or output of innovation.*

*The open system model has several important advantages over the closed system. First, it allows profitability to be achieved at all stages of innovation: not only through sales, but also through licensing or exit in earlier stages.*

*Second, it allows full use of the potential of human resources, as it also allows for "outside the box" thinking or organization thinking (Van der Merr, 2007). There is a misunderstanding regarding management techniques which are needed to implement IA initiatives, (Hagel, 2008). The contemplated objective for this analysis consists of: an analysis of the different forms for implementation IA, which should be documented. When applying IA, different mechanisms have been established in the practice, whose advantages and disadvantages have not been thoroughly debated or discussed yet.*

*In the generation of new models of open businesses, organizations must find the "right" level of internal capacities, such level should provide them the necessary flexibility for a quick and flexible adaptation to the changes of the environment, and the necessary absorption capacity to identify and take advantage of the different opportunities in the environment that are more fitting for each situation, (Mauleon et al., 2011).*

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In order for these new businesses to have a highest chance to be successful, it is necessary to overcome connection difficulties with external parts, and problems when obtaining information from the environment and market, (Eftekhari and Bogers, 2015). In the construction industry, it has been detected that the technology level is limited in comparison with other industrial areas in Chile. There is a few Chilean construction companies that see technological innovations as business opportunities, as a consequence, these companies will slowly lose their competitiveness, (Ghio and Bascuñan, 2006). The management of these construction companies must explicitly stand for innovative ideas, to make strategic decisions about the management of the company innovative activities and to provide methodical and hierarquical support during the innovation process, (Hartmann, 2006).

## 2. Methodology

The methodology used aims to examine the state of the art for: (a) Understanding the mechanisms of implementation of Open Innovation; (B) To group and make a comparison between these implementation mechanisms of Open Innovation; (C) To analyze the results, complemented by case examples to detect the use forms that could be developed in different contexts to address. A review of scientific articles was carried out, based on Scopus data in the business, management and accounting and Social Sciences categories, from 2002 to 2015, resulting in 686 articles found. After, a selection and classification of important documents was carried out according to the criteria indicated by the conceptual map, see Figure 1.

The analysis and synthesis of information allowed ordering the information obtained by evaluating according to the objectives of the study, so the consistency and coherence of existing forms of application was reviewed. The results gave consistent ways to be summarized and outlined. When reviewing innovation in the construction area, a search using both concepts in the Scopus and Scielo database was carried out in English and Spanish from 2002 to 2015. This search resulted in 23 articles in Scopus and 41 articles in Scielo, these works were classified in the same way, which helped find the inclusion of the construction area inside the Open Innovation concept.

## 3. State of the art of open innovation

The process of innovation has changed over the time, which has answered the needs of the globalization era. It is no longer possible to consider that only one organization can face the quick changes of consumers or the opening of new markets, based on the traditional or closed innovation, where the fulfilment of the innovation process is internal to the organization, (Caracqs, et al., 2009), this concept of closed innovation worked during a long time, which is no longer enough for a successful performance (Quiñones, 2012). The

Open Innovation appears as a way which allows organizations to expand their limits and possibilities (Chesbrough, 2007), which has defined their applications and tools, according to its use in particular. It can be indicated that Open Innovation has been outlined from the organization itself, which allows the academic debate and the subsequent generation of empirical models organizing its own application. The question, what practices of Open Innovation are more adequate for each organization and context? Does not have definite answers (Rodríguez, 2016).

Chesbrough, (2003), indicated that the process of traditional innovation integrates innovation activities in a vertical manner, generating the possibility of getting false positives (ideas that should solve problems) or false negatives (ideas that seem to be destined to fail).

Many authors (Furman, et al 2002; Narula, 2003; Cavusgil, et al 2003), have argued that the generation of knowledge and innovation is not necessarily the product of people working internally in the organization. This coupled with that knowledge is no longer an element capable of being contained within the borders of organizations, makes the ability to be more competitive, allowing to reach new markets and seek enhancement through partnerships and cooperation (Eickelpasch and Fritsch, 2005).

It is in this area where the paradigm of Open Innovation arises, which postulates the need to establish internal and external flows of knowledge by organizations to extract the most value from their innovative potential (Chesbrough, 2003). The first definition Open innovation was enunciated by Chesbrough (2003), as a process that expands the boundaries of the organization through which the company can accelerate internal innovation, where several sources of innovation and technology are used, whether internal or external (Chesbrough, 2006).

This proposal is supported by the new competitive environment for the generation of value, which forces companies to look for new ways to organize internal processes and design their relationships with other agents, with whom it will share risks and resources (Dahlander and Magnusson, 2005; Minshall et al, 2007). One of the most recent proposals to define Open Innovation is to describe a dynamic perspective, as "the set of actions and practices whereby companies incorporate the innovation process agents who traditionally have not participated in it, whether internal to the organization or external to it, through the integration of external knowledge, external dissemination of knowledge created internally, and cooperation in the creation of knowledge." (San Martin et al, 2012). One of the most used descriptions of the concept of Open Innovation consists of relating it to the operations, as a process with a starting and ending point inside organizations. The Open Innovation is the discipline and practice of taking advantage of non-evident findings of others as a first step in an Innovation process through formal and informal relations within an organization, (Deutsch, 2013).

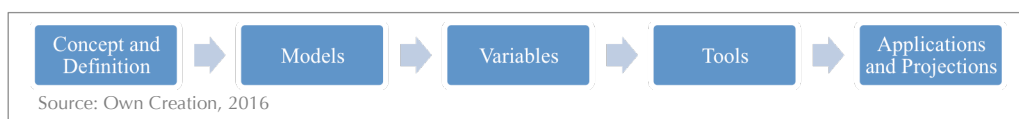


Figure 1. "Conceptual map, application of Open Innovation"

ENGLISH VERSION.....

For a group of authors (Chesbroug, 2003; Laersen and Salter, 2006; Van de Vrande, 2009; Lee, S., et al., 2010) AI is a proposal that will be largely delimited in the concept. On the other hand, it is proposed that the concept of AI, its models and practices will be absorbed in the long run by a broader framework of concepts that involves the activities of the value chain of organizations (Von Hippel and Von Krogh 2006; And Von Krogh, 2010, Huizingh, 2011). See Figure 2.

a product of parallel efforts, making possible for several of them to coexist today, including combinations thereof that have been generated by the practice and / or requirements of each organization. From the creation of the cluster concept in the nineties, together with the emphasis of globalization, it has enabled organizations to focus their innovation management towards a logic of collaboration and generation of agreements together, so the emergence of new ways of generating innovation, has a higher speed in its evolution and emergence in recent times, see Figure 3.

### 3.1 Evolution of the concept of open Innovation

This has been presented as continuous in time, highlighting that these changes have been, especially lately as

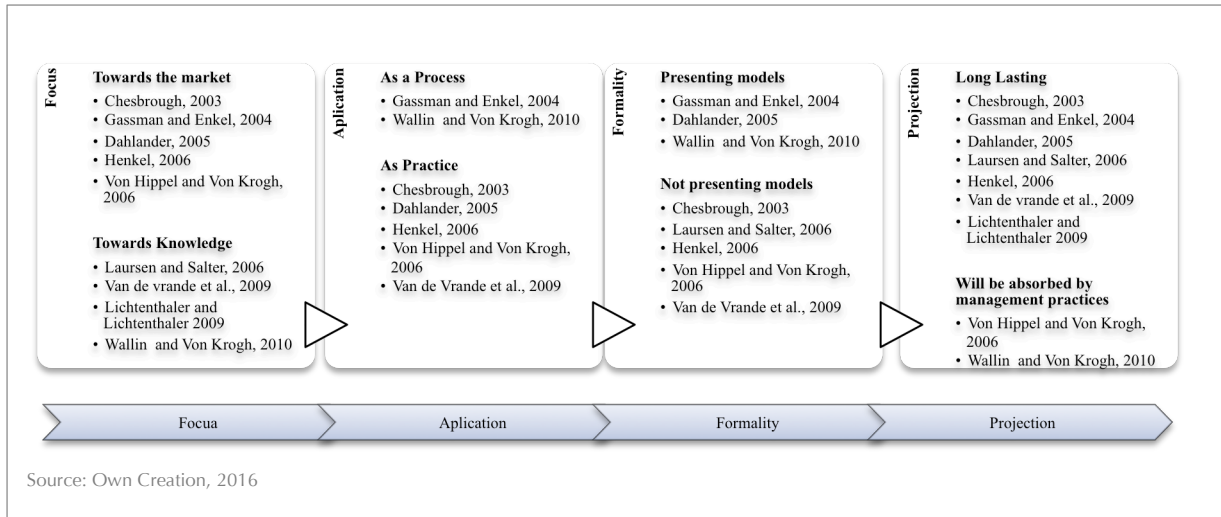


Figure 2. Open innovation definitions analysis

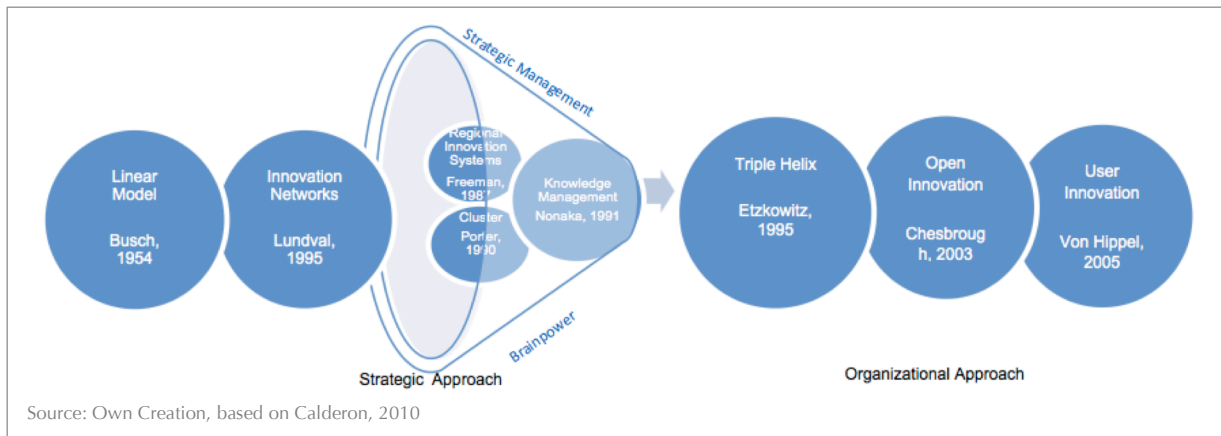


Figure 3. Evolution of the concept of open innovation in time



According to Calderon (2010), open innovation models are classified into two groups, those "strategic" where cooperation results in agreements or alliances defined almost always in a contract or similar and those "organizational" which are more structuring and designed thinking of a role of the organization that promotes receptivity. In a first stage the first models that were observed in practice characterized by emphasizing the generation of networks and connected groups that potentiated a common search around innovation, due to the development and work of this type of models It reaches a kind of cooperation scheme more defined and organized leading to models with a structure that provide a concrete framework for innovation activities undertaken together, becoming part of the organization of each of the participating entities, or formalizing an independent organization.

Figure 4 summarizes the main characteristics of the innovation models present in time, according to the sequence

observed in Figure 3, with different degrees of receptivity that have given way to open innovation model. As the degree of receptivity increases we can see that the main problem of these models is the ability to direct and control their activities, increasing the chances of frustration in the pursuit of innovation (Bogers, 2009). Operations become more complex and it becomes necessary to generate a capacity of articulation of the models that allows adequate development (Elmquist, et al.,2009). As a result of the generation of new models of open businesses, organizations must find the "right" level of internal capacities, such level should provide them the necessary flexibility for a quick and flexible adaptation to the changes of the environment, and the necessary absorption capacity to identify and take advantage of the different opportunities in the environment that are more fitting for each situation, (Mauleon et al., 2011).

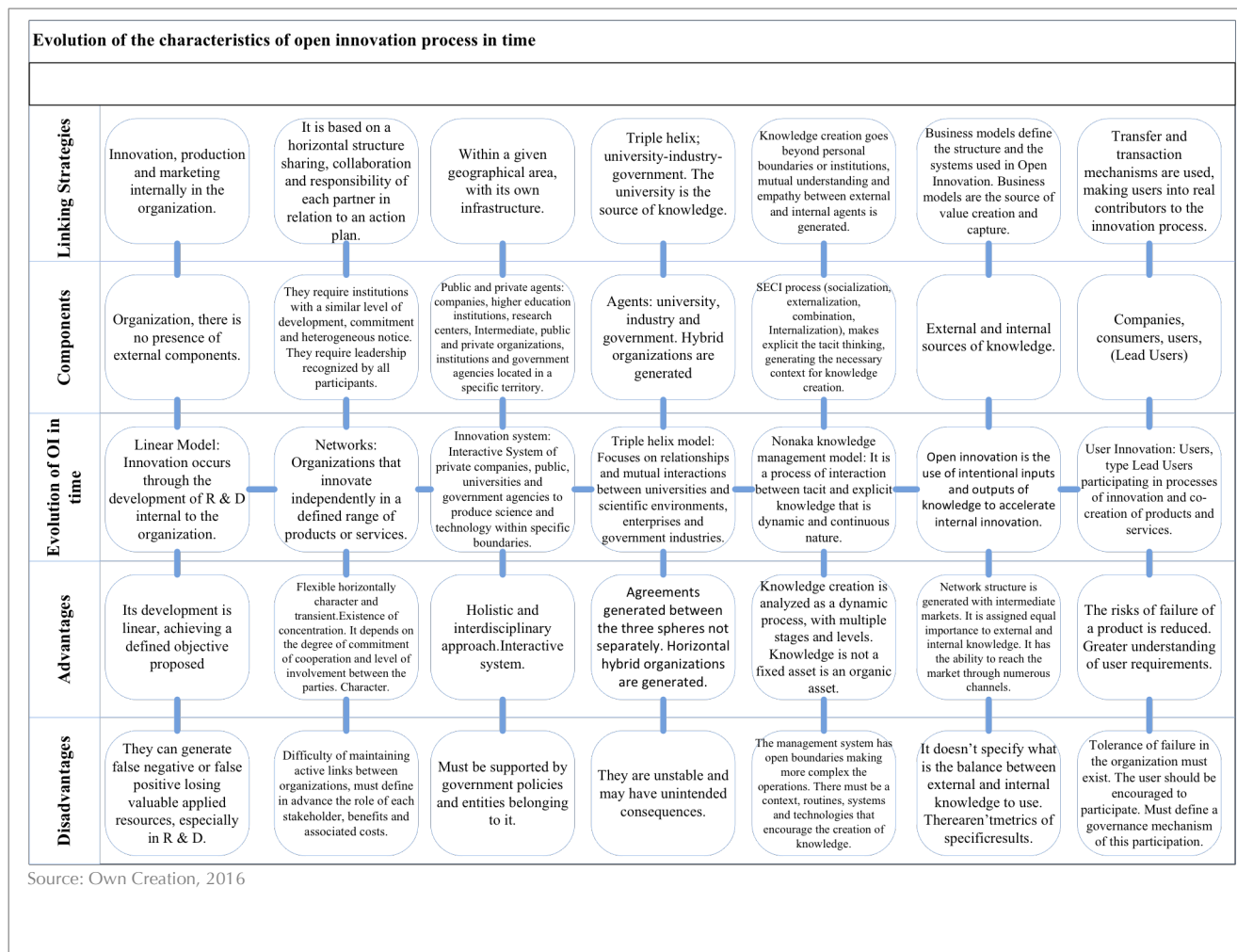


Figure 4. Evolution of the characteristics of open innovation models in time

## 4. Open innovation, towards its application

### 4.1 Open Innovation as a process

Open innovation has been described from different perspectives, with recurring definitions that address the external feature and the relationship of organizations with external actors. (Laursen, 2006), and the ones that focus towards the definition of Open Innovation as a revelation of inner knowledge abroad (Henkel, 2006). One of the mostly accepted classifications comes from Gassman and Enkel (2004) who propose a first approach to the definition of the various applications of the Open Innovation by dividing its activities into three categories: inbound, outbound and coupled activities. shown in Figure 5. Chesbrough and Bogers, (2014) define Open Innovation as “a process of distributed innovation, based on knowledge flows through the limits of the organization, using pecuniary and non-pecuniary mechanisms, in line with the business model of the organization”. In this new definition, the aspect of business

and the generation of value for the company is emphasized reaching an agreement between the concept of Open Innovation, the knowledge flow, and the capacity organizations have to rescue the associated value of the innovation process.

We can identify a second categorization of the activities of Open Innovation, which distinguishes the following classifications: Innovation of exploration from the outside to the inside of the organization; and Innovation of the exploitation from the inside to the outside of the organization (Van de Vrande, 2009). Table 1 summarizes the main characteristics and factors of convergence of these two ways of classifying Open Innovation. It is concluded that Open Innovation is the generation and management of the flow of ideas and knowledge whether incoming or outgoing, which are capable of supplying organizations with new proposals.

Dahlander (2010) indicates that the process of Open Innovation presents differences in its activities if the mechanism is pecuniary or not. So taking this classification, Table 2 shows the advantages and disadvantages of these different forms.

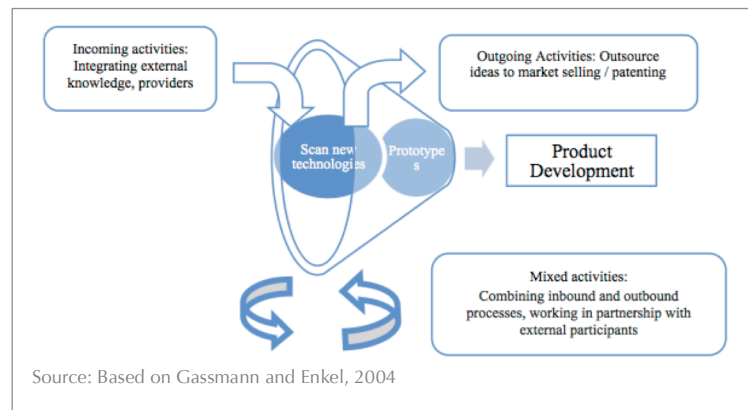


Figure 5. Activities of the process of open innovation

Tabla 1. Convergence activities open innovation process

Definition by Dahlander	Definition by Gassman	Common Issues
<b>Incoming:</b> Supply ideas and external knowledge through formal and informal relationships into the organization	<b>Exploration:</b> Organized and intentional entries of knowledge into the organization. These entries can be pecuniary or not.	Flow of ideas and external knowledge into the organization
<b>Outgoing:</b> Sale or disclosure of internal resources towards the outside of the organization	<b>Exploitation:</b> It consists of organized and intentional knowledge outputs to the outside of the organization. These outputs can be pecuniary or not	Internal flow of ideas and knowledge to the outside of the organization

Source: Own creation base don Dahlander 2010; Gassman, 2009



**Tabla 2.** Advantages and disadvantages of open innovation

Factor	INCOMING/EXPLORATION		OUTGOING/EXPLOITATION	
	Non Pecuniary REVEALING	Pecuniary SALE	Non Pecuniary SUPPLY	Pecuniary Acquisition
<b>Exchange Logic</b>	Non-pecuniary indirect benefits	Money involved in the exchange	Non-pecuniary indirect benefits	Money involved in the exchange
<b>Focus</b>	Revealing internal resources to the external environment	Licensing or sale of products on the market	Supply of ideas and external knowledge	Acquisition of input inventions for the innovation process through formal and informal relationships
<b>Advantages of directing the opening</b>	Gather resources and support. Achieving the legitimacy of the external environment. Foster cumulative and incremental innovation	Market the products that are on the "shelf"	Access to a wide range of ideas and knowledge. Discovery of new radical solutions to problems	Access to knowledge and resources of the partners. It takes advantage of the complementarity of the partners
<b>Disadvantages of driving closeness</b>	Difficulty of capturing the benefits. It can filter internal resources to competitors	External partners can be better equipped to commercialize inventions	Many sources of information can create loss of attention. Hard to choose and combine the alternatives	Difficult to maintain many links with partners. Risk of critical external dimension with partners

Source: Own creation, base don Dahlander 2010

#### 4.2 Open innovation as a process of change

According to San Martin and Rodriguez, 2012, it indicates that because there is no model defined for an organization to transit and implement Open Innovation, for that is chosen the use of the organizational change model proposed by Lewin (1951), which has the following phases.

- Unfreezing, feeling that change is necessary and urgent, communicating to stakeholders of the company, both internal and external (Kotter, 1997)
- Impulse, Implementation of change through the establishment of new processes and behavior patterns, often experimental and tentative until the most appropriate path to the claims of the company is located.
- Institutionalization, consolidation of the improvements achieved, avoiding setbacks.

On the other hand Wallin and Von Krogh, 2010, have proposed an implementation model of Open Innovation that seeks to integrate external knowledge, still remaining how to adopt integrated approaches to be used as a source of innovation.

Fetterhoff and Voelkel (2006) focus on the problems involved in the search process for innovations. They state that companies mostly do not evaluate external innovations, so that they define a model that proposes how to adopt and evaluate the flow of external innovation within the organization, we can indicate that only fits the search for external innovation:

Table 3 indicates that it is possible for the two deployment models of Open Innovation to be observed from the perspective of change management model.



**Figure 6.** Change process model of Kurt Lewin

**Tabla 3.** Convergence of open Innovation processes with the change process

Cambio Organizacional	Wallin y Von Krogh (2010)	Fetterhoff y Voelkel (2006)	
<b>(Unfreezing)</b>	Define steps of the innovation process	Seeking opportunities	It is approached as a way to get ideas, proposing targets for each model Raise its process, it can be seen that for each model, the aim of these is different because what Wallin and Von Krogh propose is associated with knowledge management and how to integrate the innovation process, while Fetterhoff and Voelkel seek ways to get associated value with the commercialization of innovations in the market of innovations
<b>(Change)</b>	Identify relevant knowledge	Market potential and inventiveness	
	Integration mechanism	Potential partners	
	Governance mechanisms	Marketing value capture	
<b>(Refreezing)</b>	Balancing incentives and control	Extension of the innovation supply	Each of the proposals raises their way to systemize the model, through incentives or increasing the supply of innovation.

Source: Own creation, 2016

Each of the models independent of its main objective meets the stages of change model, generating a cycle able to break the inertia and maintaining mechanisms for systematization in time.

**4.3. Practices and examples of application of Open Innovation**

In practice, you can find different ways of implementing Open Innovation, being used indistinctively by organizations, even sometimes the application falls in intuitive ways. Van de Vrande (2010), he makes a classification of the

different tools for the implementation of Open Innovation, which ranks in monetary or non-monetary.

The use of monetary or non-monetary forms domestically depends on a number of features, among which can be listed: peer pressure, organizational structure and culture, or the kind of innovation sought. In this case, as in others, there is no solution or decision making, optimal universal. (Saint-Martin and Rodriguez, 2012). On Table 4 we have classified application tools of Open Innovation, following categories of incoming or outgoing and whether or not correspond to economic mechanisms.

**Tabla 4. Practices and examples of Open Innovation application**

Type	Practices	Definition	Examples	
Incoming Innovation / Exploration	Pecuniary / Acquisition	Intellectual Property Purchase	It represents the way that organizations can frame new technologies in order to negotiate, and buy them if there is a willingness to develop them. Beyond register their ideas, many companies what they do also is acquire other companies to obtain their patents. The purchase of Motorola by Google, in August 2011, cost US \$ 12,500 million 17 thousand US company patents.	
		Outsourcing	How to access ideas and technologies from external sources, which have been specifically contracted to provide these. Outsourcing of innovation (innovation outsourcing) implies that cooperation units are well separated and formally connected by contract to achieve a final solution. (Rundquist, 2003). Outsourcing can lead to a loss of research and long-term development (R & D) (McDougall and Oviatt, 1997), as it often is used as a substitute for innovation. For the company KPN, a service provider of information and communications technology in the Netherlands, Belgium, outsourcing contracts are generated to drive new opportunities and capabilities, not only for cost reduction. "It had to be a combination of cost reduction and innovation together." As expressed by Hans Wijns, former vice president of IT innovation in KPN. This approach led to external equipment suppliers to design one goal, and in five months, built a new IT solution.	
	No pecuniary / Supply	Joint ventures	It is a contractual agreement that creates a separate legal entity in which the parent companies hold shares on the conditions and provisions specified in a legal document. (Carland and Carland, 1998). The "Ventures" or partners that make up the pooling agreement provide means or resources to develop a joint activity managed on an equal basis, taking aim at generating profits. The figure of the Joint Venture, possesses a contractual basis, the existence of a contract is considered a "sine qua non" condition for the existence Joint Venture, where it proceeds to a pooling of assets, efforts, knowledge or judgment, agreed the sharing of benefits that may result. (Buckley and Casson, 1996)	The International Joint Venture is a strategic option widely used by multinational companies in their international expansion efforts (Brouthers and Bamossy, 2006) and the entry form most commonly used to access developing country (Lee and Beamish, 1995).
		Strategic alliances	Agreement between two or more independent companies, joining or sharing some of their skills and / or resources, establish a degree of interaction in order to increase their competitive advantage. Generally, alliances are formed when a company is looking for partners to obtain the resources or capabilities that needs and does not have to exploit potential synergies, or to share risks for a certain time to meet specific targets or as durable as business secured without a future dissolution provided. (Rodriguez, 1999).	Philips and 3Com companies have entered into an agreement as a strategic alliance between the two companies allowing customers to benefit from the broad portfolio of Philips communications with support from proven portfolio 3Com network from the tip to the core network, with security solutions, wireless and network management.
		Networking	Intermediate organizational form between the market and the company characterized by the plurality of cooperation agreements between the different groups or stakeholders (suppliers, customers, competitors, public and private institutions, etc.). We highlight among other prominent forms of enterprise networks: (1) agreements or alliances with companies in the industry, (2) with a variety of participating companies, (3) and with suppliers, distributors and customers, depending on the desired objectives and of the groups that are willing to cooperate to achieve them. (Briones et al, 2011).	Telefonica, O2, BT, Telenor and Verizon among other operators have created communities of advanced users who validate future applications, allowing significant reductions in validation times. Philips has partnered with NH Hoteles to conduct experiments of new lighting systems in hotels.
		Customer involvement	Processes, actions and interactions where a development team collaborates with current (or potential) customers in a program, project, and / or some stage of the development process, to find specific information as latent needs, developing customer knowledge and developing new solutions to problems. (Sandel, 2007)	IBM shared with the community of open source software all the code of Eclipse, valued at 40 million dollars. By sharing this resource, IBM aims to increase the value created, obtaining a set of development tools that complement the Eclipse open platform
Outgoing innovation / Exploitation	Pecuniary / Sale	Sale of Intellectual Property	Ways in which organizations can frame new technologies to negotiate, sell on the market if they are not willing to develop them. Lately twitter created "The agreement of patent innovators" to avoid excessive protectionism when negotiating the value of a patent, in order to avoid the supremacy of larger companies over smaller ones.	
	Non pecuniary / Disclosure	Spin-off	Agreement created with the purpose of marketing one or more research discoveries outside the main activity of the company of origin. (Garvin, 1983). All spin-off initiatives are not equal, so different authors have tried to make a categorization and establish different models and types: according to their origin (academic and industrial), the technology used (technology or conventional base), strategy (reactive, proactive), reasons (restructuring, by safeguarding know-how), the impact on the strategy of the organization of origin (technical and competitive). Technology-Based Companies often linked to universities and help facilitate the transfer of scientific research to the social sector in the form of innovative products. A couple of examples of these businesses are Silicon Valley, born by the action of the Universities of Stanford and Berkeley (California, USA) and Google, a spin-off company also from Stanford University.	

Source: Own creation, based on Dahlander, 2010, Van de Vrande 2010



#### 4.4 The Open Innovation as a knowledge management.

Although, factors, which are dependent on a specific context and can determine the success of a Knowledge Management process are many and varied, Davenport (1997, 1998) cited in Gómez, (2006) identifies nine key factors that are interrelated as possible determinant of the success of a project of knowledge management: a) knowledge-oriented culture, b) technical and institutional infrastructure, c) support from the managerial staff, d) connection to the economical or market value, e) process orientation, f) clarity of the objective and language, g) practices of motivation, h) knowledge structure, i) several channels for the transfer of knowledge.

In this sense, the management of the Open Innovation project presents seven factors for success proposed by Gonzales and García (2011). Three factors are external: a) technical leadership based on experience, b) intensive use of Information and Communication Technologies, which allow a multilateral communication, and c) the presence of intermediate agents or facilitators with a neutral nature. On the other hand, the results of the Open Innovation project also depend on some internal factors: d) the linking positions, e) the searching routines and, f) the establishment of incentive systems, which promote proactivity and an organizational culture.

In each of the modules, a meaningful leadership, an infrastructure based on the Information and Communication Technologies, the transfer of knowledge, the motivational

systems and an organizational culture oriented to the innovation and knowledge are main variables for success. Both modules base their implementation on common pillars, which can be oriented to a combination of steps and common procedures.

## 5. Open innovation in the construction industry

Most of the construction companies do not find investments in I+D+i attractive because they have not understood their role as a key factor of competitiveness, Correa et al., 2007. Barrio et al., (2011) propose a model for the technological innovation management in the construction area, focused on improvements designed from inside the companies, and are applied individually by each company, generating a closed innovation module as a first step for the standardization of the innovation management. The construction industry is based on projects and people, for this reason a change in mentality and culture must be fostered in order to promote an innovation culture, as a prerequisite for the exchange of knowledge and creativity, (Castro et al., 2012).

Since then, it is assumed that a strategical nature in the innovation should lead to the development of essential capacities, which will be responsible of the future value of the organization. See Figure 7.

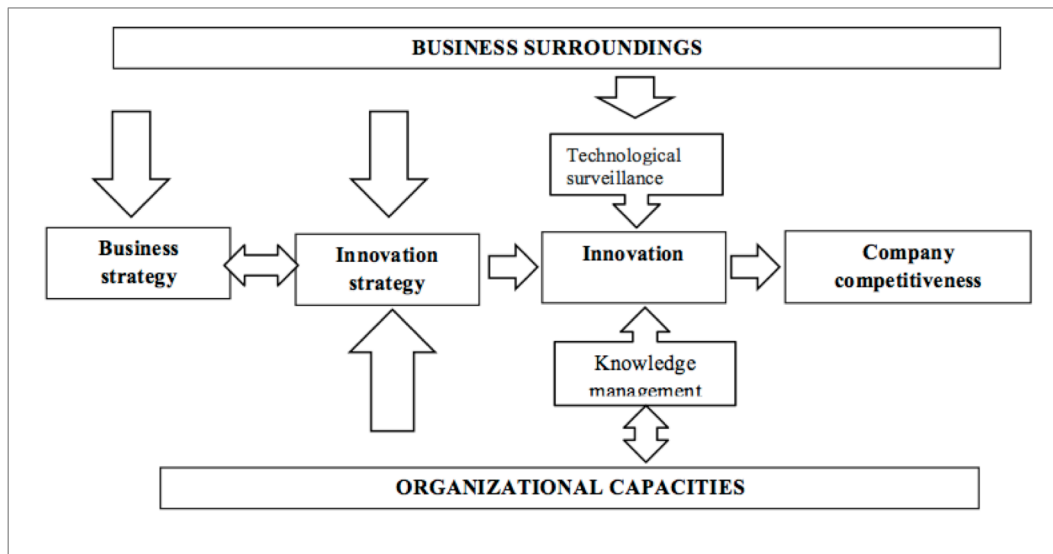


Figure 7. Competitiveness module focused on innovation



According to Correa et al., (2007), in order to get a good implementation of successful innovation systems, it is necessary to support other management systems, especially those that contribute to the efficient use of knowledge, the continuous improvement of company processes, and mainly a permanent link with the environment. It is proposed that there are six main concepts that gather the main similarities detected in his bibliographical analysis: innovation concepts, organizational capacities, business environment, strategy, complementary systems, I+D management. The development of strong bounds with providers, the knowledge management and the application of technological vigilance are crucial elements to generate the Open Innovation bases, which is observed as a preliminary strategy for the application of Open Innovation.

### **5.1 Strengthening of technological networks and technical capacities of connected services of Non-Conventional Renewable Energy in the Antofagasta region Project**

According to the proposed sequence the case of the Chilean Chamber of Construction is analyzed, through the Technology Development Corporation (CDT), who for the implementation of the project of decentralization the office in Antofagasta, has worked steadily in generating cooperation projects in the sector being one Energy Node 2015, "Strengthening technological networks and technical capabilities of related ERNC services for the Region of Antofagasta" program that was supported by CORFO (CORFO).

The objective of this project was to support companies in the photovoltaic and solar thermal industry for residential market in Calama, so that they could better respond to current national energy needs. This project will be considered as a concrete example of the application of Open Innovation, because through it the CDT is committed to promote innovation in companies linked to the construction sector, identifying technology gaps and meeting demands of expertise and dissemination of expertise and of course generating an instance for the formation of enterprise networks. The activities considered for this project were basically training starting in early 2015 and for a period of twelve months, 4 workshops, 2 technical courses, one technical seminar, 2 business meetings, 2 mass media seminars. The participation was of a total of 24 companies.

The culmination of the process of working together with companies and entrepreneurs was delivered in a publication

specifically designed for this purpose and from which the results obtained are extracted directly: Installation of new knowledge in direct beneficiaries; Market Research in Chile; Generating interest among members of the node in project development and research on the subject; Decrease information asymmetries; Networks generated jobs; Improvement of the technical and administrative capacities; communicational impact on the environment of the recipient node, end customers and stakeholders.

From the analyzed information according to the types of Open Innovation tools (see table 5), it appears that the Energy Node case corresponds closer to a kind of strategic alliance where companies come together by agreement to enhance and share synergies and risks, in this case it consisted of the strengthening of capacities and technical skills and innovation, to better respond to the energy market in the city of Calama. We can indicate that one of the first steps to begin implementing Open Innovation could be the generation of strategic alliances which then and as proposed by Van de Vrande, almost logically result in the application of other more specific tools such as Joint Venture, Networking, Spin Off. If we approach this example from the model of organizational change, it is detected that the energy nodes project coincide in some way with the implementation steps defined by Wallin and Von Krogh, Table 6.

As shown in Table 5, the proposal generated by the CDT concurs with a sample application of Open Innovation and as considered as one of the first stages in the implementation in the country and in the industrial area, it is implemented by a specific project financed directly by the state where arises as main objective strengthening the development of an industrial sector that before the project, presented organizational, operational and technical gaps to respond to the needs of the housing market for the use of alternative energies. The companies formed a fuzzy core business unable to deliver a standard technical solution for the requirements associated with the generation of alternative energy in private homes. The way to address the improvement of the supply consisted of specialization and training of enterprise networks capable of delivering a comprehensive solution to market requirements. The realization of this project is part of the three identified stages of change, as proposed by Wallin and Von Krogh, who aim to distinguish the innovation process, as a process of acquisition of knowledge able to become the basis for future innovations.



**Tabla 5.** Case analysis energy node

Case: Energy Node	Tool IA	Analysis
<p>Objectives: to support companies in the photovoltaic and solar thermal market for residential Calama, so that they could better respond to current energy needs, promoting innovation in companies associated with the project.</p> <p>Media: Centralized resources in the CDT.</p> <p>Scope: Geographical defined, defined duration.</p>	<p><b>Buying and selling Intellectual Property.</b> Objectives: Buying and selling new technologies. Media: Patents and licensing. Scope: monetary market.</p>	Purchase and sell of Intellectual Property not present
	<p><b>Outsourcing.</b> Objectives: Subcontracting to generate new technologies. Media: Financial resources, outsourced units. Scope: Limited to contract defined above.</p>	Innovation Outsourcing not present.
	<p><b>Joint Venture.</b> Objectives: Independent Legal Entity. Media: Objectives and resources specific and shared. Scope: Limited to contract defined above.</p>	Creation of an independent legal unit not present.
	<p><b>Strategic Alliances.</b> Objectives: Union between companies under common agreement. Media: Shared and specific objectives. Scope: Exploit synergies and share risks, no specific term presented.</p>	Union between companies that agreed to carry out the implementation of a specific project. The specific term of the project scope is not defined.
	<p><b>Networking.</b> Objectives: To generate intermediate network between market and enterprises. Media: shared and specific objectives. Scope: Various interest groups, depending on the objectives.</p>	While it is true, the case does not present the creation of an intermediate network between market and companies, it can be assumed as a result of project implementation.
	<p><b>Customer Involvement.</b> Objectives: Joint development with customers. Media: Not defined, own resources from company and customers. Scope: Specific objectives of development.</p>	Common development with customers not present.
<p><b>Spin off / Venturing.</b> Objectives: Agreements commercialization of new technologies. Media: Objectives and shared resources and specific. Scope: Limited to previously defined contract.</p>	Commercialization agreements of new technologies not present.	

Source: Own creation, 2016

**Tabla 6.** Project Nodes from the perspective of organizational change model

Organizational Change	Wallin and Von Krogh (2010)	Energy Node Project 2015
(Unfreezing)	Define steps of the innovation process	Finding ways to enhance Small Businesses on the photovoltaic and solar thermal industry in the city of Calama
(Change)	Identify relevant knowledge	Alternative energy generation in the residential market.
	Integration mechanism	Networks, node types
	Governance mechanisms	Led by CDT, funded by CORFO
(Refreezing)	Balancing incentives and control	Results achieved, training of work networks

Source: Own creation, 2016

## 6. Conclusions and future development

It is recognized that innovation has become an essential tool to ensure the development and growth of organizations and nations, although it is noted that implementations are not fast nor solve all the problems occurred in the development process.

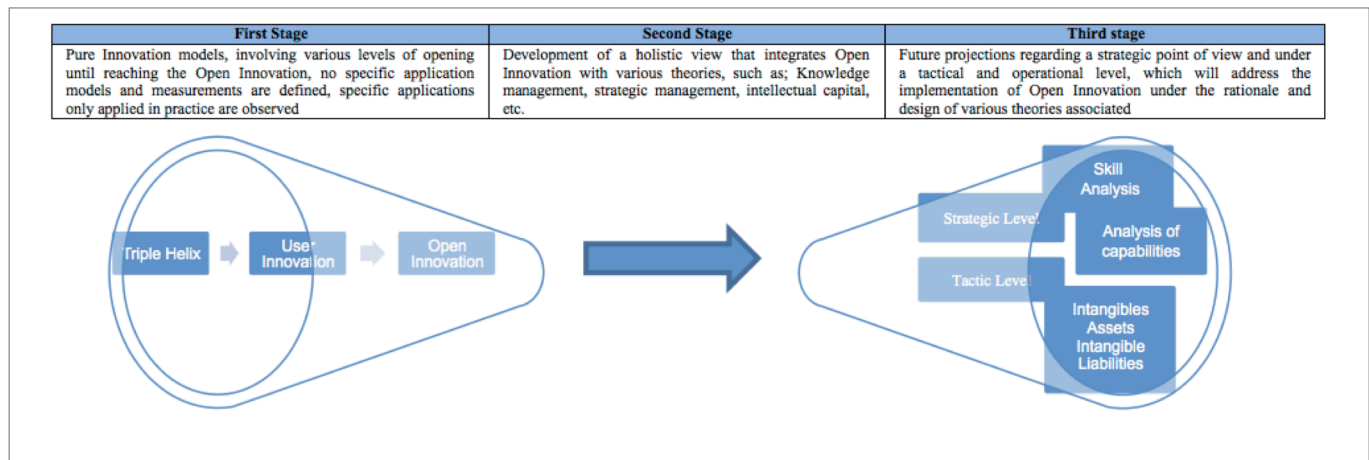
We can indicate that the concept of Open Innovation and its implementation is still a matter that occurs in practice, where it has not been determined the methodologies and strategies that help to decide and select the implementation mechanism that best suits the organization. The decision on the best practice to implement, is usually associated with external variables which has primary importance the public policies that support these processes, favoring in a sense the adoption of specific tools.

It is observed with special care the current trend of implementing specific Open Innovation applications related to external exploration processes, pecuniary or non-pecuniary, which could become an element to increase the

development gaps between nations or organizations with greater progress versus those who do not possess it, as these practices are generally associated with a centralized core of results. It is in this area where a future contribution is displayed, which is to investigate the possibilities of generating decision methodologies on using this concept or not within organizations, determining donations, contribution of this application, and above all the determination of the real contributions to the development of organizations and nations.

In the evolution of the concept of OI we have observed a process that was born from private contributions that converged towards a more holistic and inclusive approach from which it again began delving into particular issues. This way you can indicate that the evolution of the application of Open Innovation has taken three specific stages, as shown in Figure 8.

Figure 8. Open Innovation transition stages



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