

# Journal of Technology Management & Innovation

---

Volume 10, Issue 4, December 2015

## Research Articles

- Reverse Transfers of Innovation and National Development: Evidence from Brazilian Subsidiaries  
*Maitê Alves Bezerra, Felipe Mendes Borini, Maria Laura MacLennan Ferranty*..... 1
- Technology Transfer Model Proposal in Public Research Institutions: The Search for a more Effective Process in the Broiler Chain in Brazil. *Nádia S. Schmidt Bassi, Christian Luiz da Silva, Elsio Antonio P. de Figueiredo*..... 9
- Business Incubators in Brazil: Main Gaps to Be Explored by Academic Researchers  
*Gustavo Tietz, Rosley Anholon, Robert Cooper Ordoñez, Osvaldo Luiz Gonçalves Quelhas*..... 18
- Research Results Transfer towards the Productive Sector via Research Collaboration in Four Colombian Public Universities. *Maria Eugenia Morales Rubiano, Pedro Emilio Sanabria Rangel, Paola Andrea Plata Pacheco, Fabian A. Ninco Hernández*..... 28
- Mapping the Connection between Knowledge Transfer and Firm Competitiveness: An Empirical Research in the Basque Country.  
*Javier Benito-Bilbao, Francisco Sánchez-Fuente, Jose Ramón Otegi-Olaso*..... 45
- Agrobiodiversity Products by SWOT Analysis as an Analysis for Strategic Innovation  
*Amanda Valverde, Sandra Magalhães-Fraga, Jorge Magalhaes, Wanise Barroso*..... 57
- Feature Fatigue, IT Fashion and IT Consumerization - Is There a Relationship?  
*Luiz Antonio Slongo, Mery Blanck, Rafael Alfonso Brinkhues, Rafael Mello Oliveira*..... 64

## Case Studies

- Obstacles to Small Innovative Companies' Development: Case Study of Nizhny Novgorod Region  
*Nadezhda Butryumova, Svetlana Karpycheva, Khristina Grisheva, Elena Kasyanova*..... 74
- Integrating Technology, Management and Marketing Innovation through Open Innovation Models  
*Jaider Manuel Vega Jurado, David Juliao-Esparragoza, Carlos Paternina-Arboleda, Milena Velez*..... 85
- Open Innovation and Business Model: A Brazilian Company Case Study  
*Elzo Alves Aranha, Neuza Abudd Prado Garcia, Giselle Giselle Corrêa*..... 91
- Active Internationalization of Small and Medium-Sized Software Enterprises - Cases of French Software Companies. *Maurício Floriano Galimberti, Raul Sidnei Wazlawick*..... 99

## Review

- Factores Clave en la Gestión de Tecnología de Información para Sistemas de Gobierno Inteligente  
*Gina Paola Maestre G., Wilson Nieto Bernal*..... 109



# Reverse Transfers of Innovation and National Development: Evidence from Brazilian Subsidiaries

Maitê Alves Bezerra <sup>1 \*</sup>, Felipe Mendes Borini <sup>2</sup>, Maria Laura Ferranty MacLennan <sup>3</sup>

**Abstract:** The search for innovation has become an important motivation for the internationalization of companies in emerging countries. In that context, this study tests the impact that a nation's development has on whether subsidiaries transfer innovation of products or that of processes. Survey data collected from 73 subsidiaries of Brazilian companies indicate that companies located in developed markets tend to transfer more product-oriented innovations than do those based in emerging countries. Furthermore, the size and age of a subsidiary has an impact on the transfer process. The larger and younger the subsidiary, the more likely a company is to favor the flow of product innovation into its headquarters. The level of national development was not identified as an influence on the flow of process innovation.

**Keywords:** reverse transfer, innovation transfer, product innovation, process innovation, subsidiaries

Submitted: July 17th 2015 / Approved: December 4th 2015

## 1. Introduction

Multinational corporations in developing countries (DMNCs) have been prominent in both the international business (Verbeke & Kano, 2015) and the innovation process literature (Fleury *et al.*, 2013). The search for technological knowledge has become part of DMNCs' internationalization strategies (Alvaro *et al.*, 2015).

Technological knowledge developed by subsidiaries in advanced countries has been imported by DMNCs' headquarters (Iammarino *et al.*, 2008). At the same time, emerging countries have developed in-house innovation by offering new applications of imported technologies at much lower costs (Prahalad & Mashelkar, 2010), the study of innovation in emerging multinational companies has become an important research topic. Unlike companies in developed countries that are already in advanced stages of industrialization, most DMNCs still must enhance their innovation capabilities. Some authors argue that DMNCs' strategic models are guided by the search for overseas resources, such as technological knowledge, that can be combined with its existing resources (Bartlett & Ghoshal, 2000). For DMNCs, skills acquired in the international market are of obvious importance. Thus, we seek to understand the type of technological knowledge that is transferred from subsidiaries to headquarters located in emerging markets (i.e., reverse transfers of knowledge) and whether transferred knowledge varies depending on the type of environment at the subsidiary's location.

Two theoretical approaches arising out of the innovation literature are used in this study: the innovation systems (IS) approach and the emerging-markets innovations approach. The IS literature shows how developed countries' institutional environments stimulate a company's ability to innovate when developing new products (Edquist,

2005; Nelson, 1993). Product innovation is defined as a new technology or a combination of existing high-level technologies, which are sometimes disruptive and involve a high degree of investment and uncertainty (Ariffin & Figueiredo, 2004). The literature on innovation in emerging markets explains how less-developed institutional environments induce companies to overcome their restrictions (Govindarajan & Trimble, 2012; Immelt *et al.*, 2009). Ramamurti (2008) argues that the specific advantages of DMNCs are closely related to process innovation, defined as the skills used in a production system, because DMNCs have superior productive efficiency. They create a capacity to produce at low costs with few resources and a low level of technology, but with an abundant labor force. Thus, the emergence of innovations in emerging markets challenges the IS view because the process of innovation can arise in developing countries where there exist no sophisticated institutional environments that would promote it (Govindarajan & Ramamurti, 2011).

In this way, the literature indicates that DMNCs seek different types of innovation abroad. On the one hand, when subsidiaries of DMNCs are installed in developed markets, they search for product innovations. On the other hand, when DMNC subsidiaries are installed in emerging countries, they search for process innovations. These assumptions led to the formulation of our research question: Compared to DMNC subsidiaries based in developed countries, do DMNC subsidiaries based in emerging markets transfer a different type of innovation to company headquarters? To answer that question, this study uses the results of a 2013 survey of DMNC subsidiaries.

This paper aims to demonstrate that subsidiaries located in emerging markets are more likely to transfer innovations in processes compared to subsidiaries located in developed countries, which tend to transfer innovations in products. Although there are studies that propose and

<sup>1</sup> Department of International Business and Strategy, Henley Business School - University of Reading Whiteknights, Reading, Berkshire, United Kingdom

<sup>2</sup> Department of International Business Studies, Escola Superior de Propaganda e Marketing (ESPM-SP) São Paulo, Brazil.

<sup>3</sup> Department of Business Studies, University of São Paulo, Brazil

\*Corresponding author: m.alvesbezerra@pgr.reading.ac.uk



investigate knowledge transfer from DMNC subsidiaries to company headquarters (Mudambi *et al.*, 2014) none of them explain the type of transferred innovation (i.e., process- or product-oriented) to which they refer. Moreover, the results we seek deepen the knowledge of innovations in DMNCs because, according to Ramamurti (2008, p. 10), "It took many years of research to identify and empirically confirm the firm-specific advantages (FSAs) of Western MNEs, and an equally diligent effort is necessary to uncover the FSAs of EMNEs."

The ideas presented in this study can help managers to better understand the pattern of DMNCs' innovation and knowledge transfer and to facilitate the identification of the best strategies for acquiring knowledge abroad. Governments, as an integral part of both the innovation process and knowledge development, can also benefit from our findings (Edquist, 2005). It is important to understand the pattern of innovation transfer from sites with different levels of development so that governments can support companies with policies that are both appropriate and coherent.

## 2. Theoretical Background

The literature traditionally assumes that innovation and technical development originate in companies located in developed countries (Utterback, 1996). However, studies have suggested that innovation can also occur in developing countries (Govindarajan & Ramamurti, 2011; Hobday, 2005). The literature on innovation uses two approaches. First, the IS approach focuses on developing innovations in developed countries (Lundvall *et al.*, 2002). The second approach focuses on innovation studies of emerging markets (Govindarajan & Trimble, 2012; Immelt *et al.*, 2009; Ramamurti, 2008). These two research lines converge on the idea that the level of development of the environment in which a company is based affects its ability to innovate. Nevertheless, we pause to explain how this process unfolds.

### 2.1 Innovation Systems

On the one hand, for Schumpeter (1928, p. 378), innovation means proposing new uses or new combinations of factors. Nelson (1993) interprets the concept of innovation as the implementation of new products or processes. Although the OECD's Oslo Manual (OECD, 1997) has defined innovation as a broader concept, in this study innovation is split into two types: innovations in products and innovations in production processes. Product innovation comprises new technologies or technological combinations commercialised in order to meet consumer needs. On the other hand, process innovations are characterized by new uses of workforces, information and flows, task specifications, and material inputs for production (Bell & Pavitt, 1995; Utterback & Abernathy, 1975).

According to Nelson (1993), the innovation process of a firm is influenced by political and organizational considerations. Freeman (1995) states that successful innovation depends not only on research and development (R&D) but also on a wide variety of other environmental factors, such as education and science-technology systems. IS compris-

es organizations and institutions influencing the development, spread, and use of innovations (Lundvall *et al.*, 2002; Nelson, 2006).

Freeman (1995) argues that low innovation levels can be explained by factors such as inefficient educational systems for training engineers, low investment in R&D, low levels of scientific production and technology transfer, and weak relationships with industry. In line with this argument, Nelson (1993) concludes that factors such as quality education and pro-innovation policies can stimulate environments with high innovative performance. Thus, developed IS lead to enterprises with increased innovation capacity.

In recent years, the literature on the IS concept has shown accelerated progress, and its studies have primarily been conducted in the context of developed countries (Lundvall *et al.*, 2002). Innovation in developed countries tends to meet the sophisticated needs of high-income consumers (Vernon-Wortzel & Wortzel, 1988). Because developed countries have more developed IS with high levels of investment in R&D and basic science, the qualification of their workforces, good incentives to innovate, and well-structured science and technology sectors, their companies are more likely to engage in product-oriented innovation. Product innovation tends to be driven by new market needs. Therefore, it is expected that companies with high levels of product innovation rely heavily on external sources of information. Moreover, this type of innovation demands a high level of investment because there is a great deal of uncertainty about market acceptance of new products (Utterback, 1996; Utterback & Abernathy, 1975).

Thus, companies located in developed countries have access to advanced, cutting-edge technologies conceived in environments with solid IS. Such technologies are not available in developing countries due to those countries' institutional deficiencies. Thus, it is expected that by installing subsidiaries in developed countries, DMNCs seek product innovations that are not available in their home countries. These technologies, when combined with innovative, primarily process-oriented capabilities already developed by DMNCs in their countries of origin, lead such companies to build their competitive advantages. Thus, the following hypothesis is established:

H1: *DMNC subsidiaries located in developed countries tend to transfer product innovations to their headquarters.*

### 2.2 Innovation in Emerging Markets

Hobday (2005) presents a critical analysis of the innovation models that have been developed in the context of developed countries. According to that author, innovation theories fail to address the challenges faced by companies that have not reached the technological frontier. Most of the models consider only centralized R&D activities, both failing to recognize the diversity and unpredictability of the innovation process and failing to present empirical evidence. Another criticism, proposed by Figueiredo (2009), addresses the traditional metrics for measuring innovation. According to that author, innovations in emerging markets are based on small improvements in existing

processes. This fact is explained by DMNCs' lack of innovative capacity and leads to a low incidence of R&D departments and a low level of patenting activities. Thus, the number of registered patents and the amount of investment in R&D are both inappropriate metrics for assessing the level of DMNCs' innovation (Figueiredo, 2009).

Companies in emerging markets engage in considerably less product innovation than do companies in developed markets because companies in emerging markets lack high technology (Vernon-Wortzel & Wortzel, 1988). The combination of cost constraints and market opportunities is the key driver of innovation for companies in developing countries. This is because DMNCs create processes that allow them to produce at very low costs while making their goods available to large numbers of consumers (Prahalad & Hart, 2002; Prahalad & Mashelkar, 2010). These companies import technology from advanced economies (Kim, 1997) and create business models that offer low costs initially and higher quality later. By offering quality at low costs, such companies change the business models in their sectors (Govindarajan & Ramamurti, 2011; Govindarajan & Trimble, 2012; Prahalad & Hart, 2002). They are learning to "learning to do more with less for more people" (Prahalad & Mashelkar, 2010, p. 134).

Serving low- and middle-income consumers requires the development of new business models (Prahalad & Hart, 2002). Thus, the competitive advantage of DMNCs is based not on cutting-edge technologies, but instead on disruptive business models (Govindarajan & Ramamurti, 2011; Prahalad & Mashelkar, 2010). Because DMNCs do not have enough infrastructure to develop new products, they build uniquely innovative environments based on continuous improvements in their industrial processes (Prahalad & Mashelkar, 2010).

Thus, there is evidence that DMNCs that have installed subsidiaries in emerging countries are looking not for cutting-edge technologies and product innovations, but instead for new, disruptive business models. Some emerging countries have developed extraordinary methods of structuring production processes based on the constraints of their institutional environments. Such restrictions can be similar to the constraints of the environments where DMNCs' headquarters are located. Thus, the process innovations of other emerging countries can be extremely useful in building a DMNC's technological capabilities, primarily to compensate for institutional shortcomings that still challenge headquarter in its country of origin. Based on this observation, the second hypothesis of this article is established:

*H2: Subsidiaries of DMNCs located in emerging countries tend to transfer innovations in production processes to their headquarters.*

### 3. Methods

The overall objective of this research is to examine whether there are differences in the types of innovation transferred from subsidiaries of Brazilian companies as a function of the countries in which they are hosted. To this end, a survey was conducted to investigate the flow of technology transferred from the subsidiaries to the headquarters of Brazilian companies. However, because the official number of Bra-

zilian companies with manufacturing operations abroad is unknown, we sampled 63 Brazilian multinational companies in the industrial, commercial, and service sectors, all of which had foreign production units and R&D centers. These companies were identified through secondary sources such as the GINEBRA Project (Gestão Empresarial para Internacionalização das Empresas Brasileiras—*Management Systems for the Internationalization of Brazilian Enterprises*), an annual survey of the Fundação Dom Cabral (*Dom Cabral Foundation*), Valor Econômico (*The Economic Value*), and SOBEET surveys and data from the Observatório de Multinacionais Brasileiras (*Center of Brazilian Multinationals*) of the ESPM (*Superior School of Advertising and Marketing*).

From the 63 listed headquarters, we were able to identify 240 subsidiaries with manufacturing operations and R&D centers. Seventy-eight of those subsidiaries agreed to answer the survey. The data collection consisted of a questionnaire with closed questions (a 5-point Likert scale). A pretest was conducted to identify potential problems with the questionnaire. The paper questionnaire was used in the pretest, which was evaluated by three researchers in the field and three professionals in engineering and product development (Cooper & Schindler, 2006). In this step, adjustments were made in the questionnaire to improve the respondents' understanding.

After the pretest, data collection was performed by an electronic survey (Wright & Schwager, 2008). The research resulted in a total of 78 responses, totaling a rate of return of 32.5% of the subsidiaries initially identified. However, due to the existence of missing values and outliers for the variables used in the proposed research, the present study ultimately analyzed only 73 Brazilian subsidiaries.

#### 3.1 Building the research variables

The data used in this study, including both the dependent variables (the reverse transfer of process and product innovation) and the independent variables (size, age, and mode of entry), originated from the survey. Furthermore, secondary data were used (independent variable: "classification of the country as developed or undeveloped").

The dependent variable was the reverse transfer of process innovation. This construct was developed from the research by Iammarino *et al.* (2008). The type of innovation flow was classified as product innovation or process innovation. The construct of each type of innovation identified the presence of reverse transfer of: (1) new processes/products; (2) significant improvements in processes/products; or (3) the adaptation of processes/products. The construct of flow of process innovation (Iammarino *et al.*, 2008), consisting of three items, used the Cronbach's alpha of  $\alpha = 0.868$ . The second dependent variable, the reverse transfer of product innovation (Grossman & Helpman, 1991; Utterback & Abernathy, 1975), consisted of three items ( $\alpha = 0.842$ ).

The independent variable was the country where the subsidiary is located. This is because local development is an important determinant of the development of a subsidiary's capacities (Benito *et al.*, 2003). Because this study examines the flows of innovation transfer to head-



quarters from subsidiaries located in both developed and emerging markets, countries were divided into the two dimensions of developed and emerging markets. To this end, the classification given by the In-

**Table 1:** Classification of countries by level of development

Country	Subsidiaries	Classification
Angola	1	Emerging
Argentina	13	Emerging
Bolivia	2	Emerging
Chile	5	Emerging
China	5	Emerging
Colombia	7	Emerging
France	2	Developed
Germany	1	Developed
Hong Kong	1	Developed
India	1	Emerging
Italy	1	Developed
Japan	2	Developed
Libya	1	Emerging
Mexico	7	Emerging
Netherlands	2	Developed
Peru	1	Emerging
Portugal	1	Developed
Slovakia	1	Developed
Spain	1	Developed
Turkey	1	Emerging
UAE	1	Emerging
Uruguay	3	Emerging
USA	11	Developed
Venezuela	2	Emerging

Source: IMF (2010)

ternational Monetary Fund was used (IMF, 2010), as shown in Table 1. From this classification, the variable was transformed into a dummy variable (0 for developed country, and 1 for emerging country).

Some variables were controlled: foreign entry mode (*Greenfield* or acquisition), subsidiary age, and enterprise size (measured by number of employees).

The first control variable was the mode of entry abroad. The choice of entry mode into international markets can affect the decision to place

an innovation center in the subsidiary. Some authors argue that the search for innovations can be accelerated if a subsidiary is established through acquisition (Meyer *et al.*, 2009). In the case of an acquisition, it is possible that the acquired company would already have its own R&D center (Cantwell & Mudambi, 2005), which would favor innovation development in a decentralized manner. Thus, the entry mode variable used in this study was obtained from the survey and was a dummy in which 0 was Greenfield and 1 was acquired.

The age of the subsidiary was also used as control variable. This was also taken from the survey results and represented the difference between the year of a subsidiary's establishment and the year that the primary data collection was completed (2013). New subsidiaries are strongly dependent on company headquarters when making decisions (Dunning & Lundan, 2008), which can slow the development of local innovations (Cantwell & Mudambi, 2005).

Finally, the size of the unit can influence the development of innovation in subsidiaries. This is because branch size affects a subsidiary's autonomy and its ability to acquire tangible and intangible assets abroad (Johnston & Menguc, 2007). Larger subsidiaries have a greater ability to exploit economies of scale in R&D and diversify risks in their innovation portfolios (Kottaridi *et al.*, 2008). The number of employees was taken as an indication of the size of the international unit and was computed from the survey responses.

#### 4. Results

To analyze the 73 subsidiaries represented in the sample, descriptive statistics were initially used. Data analysis indicates that 32% of surveyed subsidiaries are located in developed countries and 68% in emerging markets (see Table 1).

With respect to control, it is observed that 78% of companies entered through acquisitions and 22% by Greenfield. The firms' average age was approximately 10 years, with a median of 6 years. In terms of size, only 25% of the sampled companies had more than 600 employees. In turn, 50% of the total sample had between 100 and 600 employees. Because the main objective of the research is to examine whether there are differences in the transfer of product and process innovations, it is important to note that on a 1-5 scale, the mean for process innovation is 2.45 and the mean for product innovation is 2.51. In other words, the two types of innovation are not disparate, which shows that the reverse transfer of innovation is still modest.

Table 2 shows the correlations of the variables in this study. Independent variables do not have significant correlation, which eliminates the possibility of multicollinearity, with exception of age and size, which are significantly correlated. Therefore, the two variables will be used together in the regression model only if they do not present a VIF higher than 5 (Hair Jr *et al.*, 2009). In turn, among the dependent variables there is a median and significant correlation, which indicates that an exploratory factor analysis should be carried out to verify whether the two proposed constructs truly reflect the two components (factors). The factorial is presented below:

Table 2: Correlations

	1	2	3	4	5	6
1 process	1					
2 product	.576**	1				
3 country	.132	.443**	1			
4 size	.066	.092	.180	1		
5 acquisition	-.154	.038	.145	.052	1	
6 age	-.084	-.135	.150	.715**	.000	1

Note. \*\*p&lt;0.01

Source: authors

Exploratory factor analysis was performed with the six variables of innovation that make up the two constructs. The results show a 0.793 KMO and a significant sphericity test ( $P < 0.01$ ). In Table 3, the anti-image headquarters shows that the values of MSA (main diagonal) are high and are not inferior to the other off-diagonal values, again meeting the requirements for applying the technique.

Table 3: Anti-Image Matrix

	1	2	3	4	5	6	Commonalities
1 Development of new processes	.857 <sup>a</sup>						.734
2 Small changes in the process	-.228	.791 <sup>a</sup>					.800
3 Significant improvements in the processes	-.373	-.503	.799 <sup>a</sup>				.844
4 Small adjustments in products	.078	-.269	-.053	.796 <sup>a</sup>			.724
D Significant improvements over existing products	-.257	.160	-.071	-.577	.725 <sup>a</sup>		.850
6 Developments of new products	-.009	-.090	.078	-.005	-.471	.812 <sup>a</sup>	.766

Source: authors

Moreover, it is found that all of the commonalities are above 0.700 and, therefore, are appropriate (Maroco, 2010).

The method for obtaining factors was the principal component analysis with varimax rotation. The analysis resulted in a factor (eigenvalue greater than one) with a percentage of explained variance of 79%, where Factor 1 explains 42% of the variance, and Factor 2 explains 37%. This shows that both of the retained factors have very closely weighted values for explained variance. Table 4 presents the weights of the retained factors.

Table 4: Retained Components

	Component	
	1	2
Significant improvement in process	<b>.896</b>	.203
Small changes in the process	<b>.867</b>	.222
Development of new processes	<b>.796</b>	.318
Development of new products	.096	<b>.870</b>
Significant improvement in products	.336	<b>.859</b>
Small adjustments in products	.441	<b>.727</b>

Source: authors

It is noted that Factor 1 corresponds to the innovation process construct, as previously idealized. Likewise, Factor 2 corresponds to the product innovation construct. Therefore, the constructs of process and product innovation represent two different facets of innovation that will be tested for reverse transfer by regression tests as follows.

The regression model is presented in Table 5. Multicollinearity among variables was measured by the VIF test. Because the test results show values lower than 5, no multicollinearity is found for this analysis (Hair Jr *et al.*, 2009). Models 1 and 3 show only the control variables, for product and process innovation, respectively, whereas Models 2 and 4 include the central independent variable, which is the location of the subsidiary in developed and undeveloped countries.

Table 5. Regression Models

	Process Innovation		Product Innovation		VIF
	Model 1	Model 2	Model 3	Model 4	
Constant	3.063	3.005	2.864	2.676	
Size (employees)	.001	.002	.002*	.002*	2.081
Acquisition	-.476	-.526	.006	-.153	1.027
Years at host country	-.027	-.028	-.041*	-.043**	2.059
Host Country	-x-	.331	-x-	1.067**	1.052
F	1.813	1.798	2.346	6.673**	
R2 adjusted	0.036	0.044	0.055	0.245	
* p<0.05 ** p<0.01					

Source: authors

The results show that Models 1 and 3, without the independent variable, have no statistical significance ( $F > 0.05$ ). Including the independent variable, we observe that the variables of Model 2 cannot explain the reverse transfer of this type of innovation. In the other hand, Model 4, with  $R^2$  of 24%, shows that, as expected, there is an association between product innovation and a subsidiary's location in a developed country. In addition, product innovation appears to be associated with younger and larger subsidiaries.

Thus, the results support H1, i.e., there is a relationship between a country's development and the reverse transfer of product innovation. As expected, Brazilian multinationals place subsidiaries in developed countries in an effort to obtain product innovation. This occurs due to Brazil's lack of high technology, a problem common to emerging countries that hinders the development of competitive advantages and, thus, competitive power in the international market.

Product innovation requires high levels of investment in basic science, a highly qualified workforce, partnerships between companies and local universities, high levels of firm investment in R&D, and incentives for innovation from government institutions. These are the premises of a developed institutional environment that should lead to a strong innovation system. In addition, product innovation involves high levels of investment with a high degree of uncertainty because one cannot accurately predict the market's acceptance of new products. Together, these factors make the development of product innovation not feasible in markets with unstructured institutional environments, such as Brazil.

Brazilian companies have innovative capabilities, but they are mostly focused on process innovation, which involves less investment and does not necessarily require high technology. However, to compete in a global environment, these companies need to combine the ability to innovate both in processes and in product. Thus, these companies place subsidiaries in developed countries in an effort to obtain advanced technologies. These technologies, together with the companies' existing innovative capabilities, will form their firm-specific assets, which will enable them to compete globally.

Furthermore, under our assumptions, the results show that larger subsidiaries are more likely to engage in the reverse transfer of product

innovation. However, contrary to our expectations, it is the newest subsidiaries that most often engage in this type of transfer. One reason for the relationship between subsidiary age and frequency of innovation transfer is the search for knowledge as a strategy for the internationalization of Brazilian companies (Bartlett & Ghoshal, 2000; Ramamurti, 2008). Once knowledge is acquired, the flow of transfer of innovations from subsidiaries is reduced (Kim, 1997). No relationship between innovation transfer and the mode of entry was found.

Finally, the results cannot support H2, i.e., no relationship was found between the reverse transfer of process innovation and a country's level of development.

## 5. Conclusions

Within the DMNC context, the purpose of this article has been to compare the differences in the flow of innovation transferred from subsidiaries to their headquarters according to the environment in which they are located. More specifically, it was expected that DMNCs' subsidiaries located in developed countries would be more likely to transfer product innovation to their headquarters, whereas subsidiaries located in emerging countries would be more likely to transfer process innovations.

The results support the hypothesis that subsidiaries located in developed countries are more likely to transfer product innovations to their headquarters. However, the results do not support for the hypothesis that subsidiaries located in emerging countries are more likely to transfer innovations in process.

These results confirm the fact that in the process of internationalization, emerging multinational companies, specifically Brazilian companies, allocate their subsidiaries in developed countries for the purpose of obtaining advanced technologies for product development. From this relationship, control variables were identified to examine the profile of these subsidiaries. The data show that the youngest and largest subsidiaries are most likely to transfer this type of innovation. Therefore, the most structured and largest units are the fittest to transfer innovations. The age of these units, however, was an unexpected finding. However, a possible explanation for the transfer occurring in

younger subsidiaries is precisely the driven factor of the internalization process of these companies. When the primary objective is to access high technology (Bartlett & Ghoshal, 2000), as knowledge is acquired and absorbed (Kim, 1997) the flow of the reverse transfer of innovation is reduced.

This study, does not find support for an influence by the level of the development of the subsidiary's country on the reverse transfer of process innovation. This leads us to believe that a subsidiary can develop process innovation and transfer it to headquarters in any environment. One explanation for this finding is that when a subsidiary is allocated to an environment different from the one in which it originated, it tends to adapt its counterpart to those already established in this environment (DiMaggio & Powell, 1983). Thus, business units can access new ways of operating (processes), which may differ from their headquarters' organizational forms; thus, they can develop and transfer innovation processes in both developed and emerging environments.

From an academic perspective, this paper makes some important contributions. According to Lundvall *et al.* (2002), the literature on IS needs to be better developed and adapted to emerging countries. Additionally, there is a need to understand how innovation transfer occurs in different environments. Thus, this paper has considerable implications for the IS literature, showing the flow of innovation in companies from emerging countries and testing the impact of emerging and developed environments in that process.

Govindarajan and Ramamurti (2011) state that understanding the types of innovation generated in emerging markets based on the literature on IS is an important line of research that needs to be developed. Thus, by merging the two approaches (IS and innovation in emerging markets) to understand the importance of the environment in the innovation process, this paper deepens the international business and innovation literature. Innovation in emerging markets is growing quickly and is greater than ever before (Govindarajan & Ramamurti, 2011). Therefore, this research contributes to a better understanding of the innovation phenomenon.

The paper also presents implications for policy makers because it confirms the already-established idea that developed IS are conducive to product innovations (Freeman, 1995; Lundvall *et al.*, 2002; Nelson, 1993; Utterback, 1996; Utterback & Abernathy, 1975). The results also contribute to management practices by introducing a small but important part of the innovation pattern of emerging multinational corporations. Because such companies are increasingly becoming international, with subsidiaries in many types of environments, it is important for managers to understand how differences in environments can contribute to the development of firm-specific assets.

This study's limitations are related primarily to our choice of control variables because just a few factors that influence the process of reverse transfer of innovation have been uncovered. The sample size and the origin of the sampled companies might also be a limiting factor of this research because they can reflect only the specific reality of those particular companies.

One suggestion for future research is the use of multinationals from different sources to verify whether this study's results could be extended to emerging markets worldwide or whether they are particular to Brazil. We also propose a more detailed investigation of the degree of absorption of innovations transferred from subsidiaries to headquarters, both to find what type of innovation is more relevant to the companies and to understand how headquarters are absorbing and learning the technologies transferred from their subsidiaries.

## Acknowledgements

We acknowledge the financial support provided by FAPESP and The Observatório de Multinacionais Brasileiras - ESPM.

## References

- Alvaro, C.-C., Rajneesh, N., & Un, C. A. (2015). Internationalization motives: sell more, buy better, upgrade and escapenull. *Multinational Business Review*, 23(1), 25-35. doi: 10.1108/MBR-02-2015-0009
- Ariffin, N., & Figueiredo, P. N. (2004). Internationalization of innovative capabilities: counter-evidence from the electronics industry in Malaysia and Brazil. *Oxford Development Studies*, 32(4), 559-583. doi: 10.1080/1360081042000293344
- Bartlett, C. A., & Ghoshal, S. (2000). *Going Global: Lessons from Late Movers*. USA: Harvard Business Review.
- Bell, M., & Pavitt, K. (1995). The development of technological capabilities. In I. Ul Haque, M. Bell, C. Dahlman, S. Lall & K. Pavitt (Eds.), *Trade, technology and international competitiveness* (pp. 69-101). Washington, DC: The World Bank.
- Benito, G. R. G., Grogaard, B., & Narula, R. (2003). Environmental influences on MNE subsidiary roles: economic integration and the Nordic countries. *Journal of International Business Studies*, 34(5), 443-456. doi: <http://dx.doi.org/10.1057/palgrave.jibs.8400047>
- Cantwell, J., & Mudambi, R. (2005). MNE competence-creating subsidiary mandates. *Strategic Management Journal*, 26(12), 1109-1128. doi: 10.1002/smj.497
- Cooper, D., & Schindler, P. (2006). *Métodos de Pesquisa em Administração*. Porto Alegre: Bookman.
- DiMaggio, P. J., & Powell, W. W. (1983). The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review*, 48(2), 147-160. doi: 10.2307/2095101
- Dunning, J. H., & Lundan, S. M. (2008). *Multinational enterprises and the global economy*. Cheltenham, U.K: Edward Elgar.
- Edquist, C. (2005). Systems of innovation. In J. Fagerberg, D. C. Mowery & R. R. Nelson (Eds.), *The Oxford handbook of innovation* (pp. 181-208). New York: Oxford University Press.



- Figueiredo, P. N. (2009). *Gestão da inovação: conceitos, métricas e experiências de empresas no Brasil*. Rio de Janeiro, RJ: LTC - Livros Técnicos e Científicos Editora S.A.
- Fleury, A., Fleury, M. T. L., & Borini, F. M. (2013). The Brazilian Multinationals' Approaches to Innovation. *Journal of International Management*, 19(3). doi: <http://dx.doi.org/10.1016/j.intman.2013.03.003>
- Freeman, C. (1995). The 'National System of Innovation' in historical perspective. *Cambridge Journal of Economics*, 19(1), 5-24.
- Govindarajan, V., & Ramamurti, R. (2011). Reverse innovation, emerging markets, and global strategy. *Global Strategy Journal*, 1(3-4), 191-205. doi: [10.1002/gsj.23](http://dx.doi.org/10.1002/gsj.23)
- Govindarajan, V., & Trimble, C. (2012). Reverse innovation: a global growth strategy that could pre-empt disruption at home. *strategy & Leadership*, 40(5), 5 - 11. doi: [10.1108/10878571211257122](http://dx.doi.org/10.1108/10878571211257122)
- Grossman, G. M., & Helpman, E. (1991). Trade, knowledge spillovers, and growth. *European Economic Review*, 35(2-3), 517-526. doi: [http://dx.doi.org/10.1016/0014-2921\(91\)90153-A](http://dx.doi.org/10.1016/0014-2921(91)90153-A)
- Hair Jr, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2009). *Análise Multivariada de Dados* (Vol. 6). Porto Alegre: Bookman.
- Hobday, M. (2005). Firm-level Innovation Models: Perspectives on Research in Developed and Developing Countries. *Technology Analysis & Strategic Management*, 17(2), 121-146. doi: [10.1080/09537320500088666](http://dx.doi.org/10.1080/09537320500088666)
- Iammarino, S., Padilla-Pérez, R., & von Tunzelmann, N. (2008). Technological capabilities and global-local interactions: The electronics industry in two Mexican regions. *World Development*, 36(10), 1980-2003.
- IMF. (2010). Frequently Asked Questions. Retrieved July 2013 <http://www.imf.org/external/pubs/ft/weo/faq.htm>
- Immelt, J. R., Govindarajan, V., & Trimble, C. (2009). How GE is disrupting itself. *Harvard Business Review*, October, 56-65.
- Johnston, S., & Menguc, B. (2007). Subsidiary size and the level of subsidiary autonomy in multinational corporations: a quadratic model investigation of Australian subsidiaries. *Journal of International Business Studies*, 38(5), 787-801. doi: <http://dx.doi.org/10.1057/palgrave.jibs.8400294>
- Kim, L. (1997). *Imitation to innovation: The dynamics of Korea's technological learning*. Cambridge, MA: Harvard Business School Press.
- Kottaridi, C., Papanastassiou, M., Pitelis, C. N., & Thomakos, D. D. (2008). The Multinational Corporation and the Global Sourcing of Knowledge: Remodeling Absorptive Capacity. *Economic and Social Research Institute (ESRI)*.
- Lundvall, B.-Å., Johnson, B., Andersen, E. S., & Dalum, B. (2002). National systems of production, innovation and competence building. *Research Policy*, 31(2), 213-231. doi: [http://dx.doi.org/10.1016/S0048-7333\(01\)00137-8](http://dx.doi.org/10.1016/S0048-7333(01)00137-8)
- Maroco, J. (2010). *Análise Estatística com o PASW Statistics (ex-SPSS)*. Portugal, Lisboa: Editora ReportNumber.
- Meyer, K. E., Estrin, S., Bhaumik, S. K., & Peng, M. W. (2009). Institutions, resources, and entry strategies in emerging economies. *Strategic Management Journal*, 30(1), 61-80. doi: [10.1002/smj.720](http://dx.doi.org/10.1002/smj.720)
- Mudambi, R., Piscitello, L., & Rabbiosi, L. (2014). Reverse Knowledge Transfer in MNEs: Subsidiary Innovativeness and Entry Modes. *Long Range Planning*, 47(1-2), 49-63. doi: [10.1016/j.lrp.2013.08.013](http://dx.doi.org/10.1016/j.lrp.2013.08.013)
- Nelson, R. R. (1993). *National Innovation Systems: A comparative analysis*. New York: Oxford University Press.
- Nelson, R. R. (2006). Sistemas Nacionais de Inovação: retrospecto de um estudo. In R. Nelson (Ed.), *As Fontes do Crescimento Econômico* (Vol. Clássicos da Inovação, pp. 427- 467). Campinas: Unicamp.
- OECD. (1997). Oslo Manual: The measurement of scientific and technological activities – Proposed guidelines for collecting and interpreting technological innovation data (pp. 35-54).
- Prahalad, C. K., & Hart, S. L. (2002). The fortune at the bottom of the pyramid. *Strategy+Business*, 26(1st quarter), 2-14.
- Prahalad, C. K., & Mashelkar, R. A. (2010). Innovation's Holy Grail. *Harvard Business Review*, 88(7/8), 132-141.
- Ramamurti, R. (2008). *What Have We Learned About Emerging-Market MNEs? Insights from a Multi-Country Research Project*. Paper presented at the Emerging Multinationals: Outward FDI from Emerging and Developing Economies, Copenhagen, Denmark.
- Schumpeter, J. A. (1928). The Instability of Capitalism. *The Economic Journal*, 38(151), 361-386. doi: [10.2307/2224315](http://dx.doi.org/10.2307/2224315)
- Utterback, J. M. (1996). *Dynamics of innovation USA*: Harvard Business School Press.
- Utterback, J. M., & Abernathy, W. J. (1975). A dynamic model of process and product innovation. *Omega*, 3(6), 639-656. doi: [http://dx.doi.org/10.1016/0305-0483\(75\)90068-7](http://dx.doi.org/10.1016/0305-0483(75)90068-7)
- Verbeke, A., & Kano, L. (2015). The New Internalization Theory and Multinational Enterprises from Emerging Economies: A Business History Perspective. *Business History Review*, 89(03), 415-445. doi: [10.1017/S0007680515000689](http://dx.doi.org/10.1017/S0007680515000689)
- Vernon-Wortzel, H., & Wortzel, L. H. (1988). Globalizing strategies for multinationals from developing countries. *Columbia Journal of World Business*, 23(1), 27-36.
- Wright, B., & Schwager, P. H. (2008). Online Survey Research: Can Response Factors Be Improved? *Journal of Internet Commerce*, 7(2), 253-269. doi: [10.1080/15332860802067730](http://dx.doi.org/10.1080/15332860802067730)

# Technology Transfer Model Proposal in Public Research Institutions: The Search for a more Effective Process in the Broiler Chain in Brazil

Nádia S. Schmidt Bassi <sup>1,3</sup>, Christian Luiz da Silva <sup>2</sup>, Elsie Antonio P. de Figueiredo <sup>3</sup>

**Summary:** Brazilian agricultural and livestock represent 22.54% of the Brazilian Gross Domestic Product. The Brazilian Agricultural and Livestock Research Company aims to develop technologic solutions for this sector. It has an approximate annual budget of 2.5 million dollars and 2,440 researchers. The researches target audience diversity makes more challenging the Technology Transfer process for the institution. The objective of this article was the proposal and validation, under the perception of the broiler productive chain agents, of a Technology Transfer model to optimize the public-private interaction for the institution. Were interviewed 142 agents, with a statistically significant sample, higher than 95%. The results demonstrated the contribution of Embrapa for the technological development of the chain is perceived as low, but the Technology Transfer model presented was considered essential by 96.77% of the respondents to optimize the Technology Transfer of Embrapa Pigs and Poultry to the chain.

**Keywords:** Public Research Institutions; Embrapa; Technology Transfer; Broiler productive chain.

Submitted: August 26th 2015 / Approved: December 8th 2015

## 1. Introduction and objectives

For Schwartzmann (2002), we are before an important paradox: Brazil spends most of its public research resources in applied activities, but the results are not used nor appear as they should appear. For the author, this situation derives from the existence of a strategy among researchers of basic areas, "of presenting their projects as if they were applied, to obtain more funds" (Schwartzmann, 2002, p.386).

Considering that the transfer of the technologies generated in the IPPs is the consecration of all the energy spent for the knowledge generation and the security of the research validity, via technology adoption, is admitted that among the limiting factors for adoption of the generated technologies is their transfer form (Schaun, 1981). The comprehension of that problem goes unquestionably for the need of executing a technology transfer strategy in which prevail now forms of relationship among the diverse actors of these processes. Besides that, Wildner et al (1993), highlights that must be considered the possibility that the generated technology may not be in concordance with the reality of the social system that wants to be modified, due to, mainly, the lack of integration among research-user.

In this context, the Brazilian agricultural and livestock represented in 2013 22.54% of the Brazilian Gross Domestic Product (CEPEA, 2015) and Embrapa (Brazilian Company of Agricultural and Livestock Research) is the IPP responsible for developing technological solutions for Brazilian agricultural and livestock. This institution has an approximate budget of 2.5 million dollars per year and employs

2,440 doctor researchers, but the diversity of the target audience of the developed researches turns the Technology Transfer process into a great challenge for the institution. Embrapa operates through 46 decentralized research units. Each unit is focused in a specific product or service. For this research was decided to study the TT process of the unit called Embrapa Pigs and Poultry, which develops researches for the Brazilian poultry and pig chains.

The objective of this article was the proposal and validation, under the perception of the agents involved in the chain, of a technology transfer model to optimize the public-private interaction for the institution.

The model presented in this research aims to promote a higher interaction of Embrapa Pigs and Poultry with the chain, to know its research demands, which also may subsidize other public institutions working with knowledge and technology transfer for innovation in products and services.

This article is composed of this Introduction (section 1), followed by four more sections. Section 2 presents the survey methodology. Section 3 is a summary about the technology transfer process in public institutions, followed by section 4 which presents the characteristics of Embrapa and its TT process. The fifth section presents Embrapa Pigs and Poultry and its TT process. The sixth section brings the details of the proposed technology transfer model, followed by the survey results and, finally, the conclusion of the work, in the eighth section.

1 UTFPR (Universidade Tecnológica Federal do Paraná), Brazil.

2 Programa de Pós-graduação em Tecnologia, UTFPR, Brazil.

3 Embrapa, Brazil.

\*Corresponding author: nadia.bassi@embrapa.br



## 2. Methodology

To validate the proposed TT model was elaborated a register of the companies related to the broiler productive chain. For that, was used the industrial aviculture Gessulli Guide, available at: <http://www.guiagessulli.com.br/>.

The register was divided in five links: Agricultural industries, Equipments, Genetics, Nutrition and Health. Besides that register, was searched with the researchers of the aviculture area of Embrapa Pigs and Poultry, suggestions of people which may significantly contribute to the survey. Thereby, the selection criteria of those agents, was made

in two forms: the Industrial Aviculture Gessulli Guide and the indication of researchers of the area. The production and industrialization segments of the broiler productive chain were selected due to the fact that most researches made by Embrapa Pigs and Poultry are targeted to these two segments.

The interview script was elaborated from the information obtained by the literature analysis, of internal institution documents and analysis of the institution technology transfer process, made in previous researches. In the elaboration, we tried to evaluate the knowledge and the perception of the respondents regarding the issues in question besides of linking theoretical aspects presented in this work.

For dealing with the information obtained in the semi-structured interviews, was made a qualification by group of issues addressed. For the analysis of the answers, the questions were divided in five groups (Table 1).

Table 1 - Qualification of the groups by issues addressed Groups

Survey protocol questions	
Characterization of the respondents and company	Nome of the respondent; Company; Sector of activity; Position, Range of the company, Nr. of employees; Location;
Contribution of Embrapa	Technologies developed by Embrapa and adopted by the company; forms of promoting more interaction with the chain, focus of RD&I efforts.
Relationship with IPPs	Relationship difficulties with IPPs; best form for IPPs to develop efficient technologies.
Validation of the TT Model	Agrees with the creation of an observatory; role of Embrapa in the observatory; role of the companies of the observatory; links that must participate; interaction forms of the observatory; formalization of the observatory and participation in the observatory.

Source: Own authorship

Were interviewed 142 agents, with direct involvement in the issues addressed by the survey. The questionnaires were sent using-se the program *Lime Survey*, in the period from November 20<sup>th</sup>, 2014 to February 15<sup>th</sup>, 2015.

The objective was to know the perception of the respondents regarding the contribution of Embrapa Pigs and Poultry to the chain and validate the TT model proposed for Embrapa Pigs and Poultry.

The type of sampling selected for the survey was the single randomized, in which all elements have the same probability to be selected. The formula used for the calculus of the random sample was indicated by Santos (2014):

$$n = \frac{N * z^2 * p(1 - p)}{z^2 * p(1 - p) + e^2 * (N - 1)}$$

n: calculated sample

N: population

z: normal standardized variable associated to the level of confidence

p: probability of the event

e: sampling error

The sampling error attributed for the calculus was 5%, with a level of confidence of 95% for a population of 190 persons. The number of the wished sample, therefore, was 142 respondents.

The pre-test of the questionnaire was made with 4 agents, with each one of them representative of a chain link. The selection of the pre-test integrants was made by the knowledge about the issues addressed, as well as by the proximity with the researcher. The pre-test helped in the adaptation of the questions vocabulary and insertion of explicative notes in technical terms unknown by the respondents, as well as for measuring the estimated answer time of the questionnaire. Considering that there was not any variable modification, all the answers were incorporated as valid.

### 3. Technology transfer in public research institutions

In Schaun's (1981) opinion, the technology transfer is the consecration of all the energy spent for the generation of the knowledge and the security of the research validity, by means of technology adoption. Among the limiting factors for the adoption of the generated technologies, are the transfer form and the possibility that the generated technology is not in concordance with the reality of the social system that wants to be modified, due to, mainly, the lack of integration among research-user (Wilder *et al.*, 1993).

In this sense, Fujisaka (1994) enumerates a series of reasons why the technologies generated are not adopted and among which, that the technology results from a poorly formulated problem by the research, in other words, the users do not have the problem that the researchers assumed. This ascertainment leads to the need of setting a "two-way" communication process, in other words, the integration among the diverse actors involved in the technologic innovation process, aiming to facilitate the technology adjustment to the conditions prevailing in the productive unit (Tagliari, 1984).

In that context, Schwartzmann (2002) affirms that we are before an important paradox: Brazil spends most of its research resources in applied activities, but the results are not used nor appear as they should appear. For the author, this situation derives from the existence of a strategy, among researchers of basic areas, "of presenting their projects as if they were applied, to obtain more funds" (Also exists other scenario in which the research is made with applied objectives, but its results are never applied). According to the author:

This is also a known situation, which receives the name of "shelf research": the work advances until the elaboration of a prototype, for example, or of a pilot project, but never transforms into a tradable product, or into an operational and practical procedure, in the private sector, or in the public sector (Schwartzmann 2002, p. 386).

For Schwartzmann (2002), there are several possible reasons for this situation, but, the most common is that, despite of the intentions of researchers and financing agencies in producing applicable and profitable results, there are no buyers or users for these results.

Agricultural technologies, according to Atkinson *et al.* (2003), repre-

sent a special challenge for the technology transfer programs of the public institutions which must balance the objectives of technology commercialization with the social and financial objectives. According to Pineiro (2007), the IPPs must join forces with the private sector to finance resource sources and trained personnel, as the agricultural and livestock innovation always happens collaboratively among public institutions, the scientific community and researchers. Considering the growing importance of the private sector in the innovation process, the challenge of the public sector is to work with these new players (Pineiro, 2007).

Several authors (Krieger and Galembeck, 1990; Schwartzmann, 2002; Kim, 2005; Póvoa, 2008, among others) highlight the absence of a link between researchers and companies' professionals and the need of having a tightening of the relationship between both for they to work in a more integrated form aiming to present efficient solutions for the existing problems.

In this context, the proposed model was built with the objective of meeting those needs, besides of considering the peculiar characteristics of the broiler productive chain and of Embrapa, as a public research institution.

### 4. Embrapa

Brazilian Agricultural and Livestock Research Company was created in April 26<sup>th</sup>, 1973 and is linked to the Agriculture, Livestock and Supply Ministry (MAPA). To accomplish its mission of enabling solutions of research, development and innovation for the sustainability of agriculture, in benefit of the Brazilian society, operates as a network, with 17 Administrative Units located in Brasília/DF, and 46 Decentralized Research Units, 16 business offices, distributed in several regions of Brazil (Embrapa, 2008).

With partnerships in the USA, France, Germany, England, South Korea, China and Japan (in phase of implantation), with the objective of generating new knowledge for development of innovative technologies, promoting opportunities of international cooperation in agricultural and livestock research, strengthening research networks and monitor world tendencies. Also have projects in Africa, Venezuela, Central America and the Caribbean, with the objective of disseminate the developed technologies for those countries, aiming to expand the agricultural development (Embrapa, 2015).

Embrapa coordinates the National System of Agricultural and Livestock Research (SNPA), formed by federal and state public institutions, universities, private companies and foundations which, through cooperation, execute researches in the different geographic areas and scientific knowledge fields.

#### 4.1. Technology Transfer in Embrapa

The TT process is coordinated by the Technology Transfer Executive Board, which have under its supervision the Technology Transfer Department – DTT, the Business Department – SNE and the Decentralized Units.



The more used forms for transferring technologies and generated knowledge are:

- Technology diffusion, which is the appropriation by the target audience of knowledge exempt of intellectual protection, promoted by rural extension agents, technical assistance, diffusion networks, using field days, observation units, courses, lectures, publications and medias and
- Commercialization of technologies, which can be done by signing of contracts like: Use licensing; Alienation or direct sale; Providing of services (consultancies, Counseling, product tests).

Despite the Technology Transfer Department (DTT) systematizes the TT strategies with the Units, some sub-processes are coordinated by other departments and TT strategies are decentralized developed, directly by the research units.

The main instruments used for TT are the technical courses, field days, lectures, demonstrative and observation units, technological showcases, events, business plans, technical publications, radio and TV programs and mini-libraries.

The identification of the research demands is made for each unit, following a guiding document called Embrapa Directive Plan (PDE). Embrapa does not have an official TT model, only exist some already applied models for specific technologies.

Eldred and McGrath (1997), Garnica and Torkomian (2009) and Schaun (1981), point out the importance of a well-structured TT management process, with a clear definition of roles and responsibility for all involved employees, because the result transfer success, according to those authors, largely depends of clearly defined and managed methodologies.

## 5. Embrapa Pigs and Poultry

Embrapa Pigs and Poultry is a decentralized unit of the Brazilian Agricultural and Livestock Research Company. Its mission is to "Enable research, development and innovation solutions for the sustainability of pig farming and aviculture in benefit of the Brazilian society".

Created in June 13<sup>th</sup>, 1975, to develop researches in the pig farming area. In 1978, also received the task of poultry research, receiving the name Pigs and Poultry National Research Center, called today Embrapa Pigs and Poultry.

Today, have a staff of 211 employees, formed by 51 researchers (86% doctors and 14% masters), 55 analysts, 37 technicians and 68 assistants. The team of researchers is divided by area with: 36% in aviculture; 38% pig farming and 26% working in both areas. The unit budget varies according to the approved project portfolio. In 2014, the budget was R\$ 5.07 millions.

### 5.1. Technology Transfer in Embrapa Pigs and Poultry

Embrapa Pigs and Poultry uses the same instruments of Embrapa Head Office, in other words, the knowledge generated that is exempt of intellectual protection are transferred to the public by technical publications, Medias and technical events. The other technologies are transferred by contract.

The more used types of contract are the technical cooperation contracts - where the technology is developed in partnership with the private company, and then commercialized by it by means of a licensing of use contract; and the contracts for commercialization of technologies - when the technology is developed only by Embrapa, which transfers it to the partner to commercialize it, paying royalties on the sale. The unit also uses the consultancies providing of services modality, courses and trainings.

The TT process in the Unit include several areas, mainly the sectors of Technological Prospection and Evaluation (SPAT) and Technology Articulation and Implementation Sector (SPIT), which, due to the nature of the activities have the participation of employees of other sectors and, mainly, of the researchers.

A survey made in 2013 by Bassi and Silva (2013) with the professionals that work in the unit TT area, demonstrated that the elaboration of the TT strategies are not clearly defined, and, when they are outlined, are too specific, directed for specific projects and discussed without the participation of the transfer professionals.

Other factor appointed was the preoccupation of the professionals regarding the technologies developed by the Unit, which, according to the professionals, great part of them do not meet the chain demands.

Those facts point out the need of the creation of a mechanism allowing identifying the main demands of the chains in which the Unit is inserted, with the objective of developing proper solutions to meet those demands. Such a mechanism is essential, considering that the existence of demand for the technology or service is a required condition for the transfer, and the knowledge of the demand makes possible to identify the needs, guiding the research and development works.

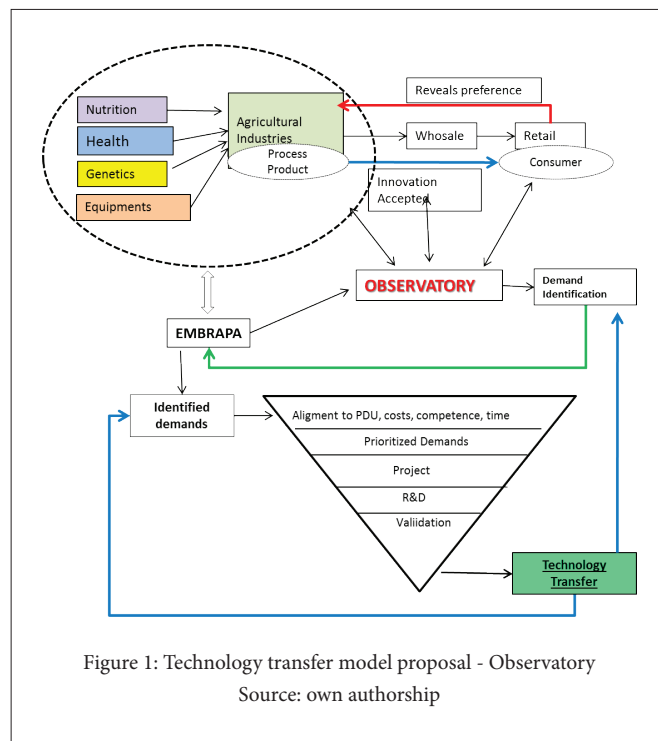
### 6. Technology transfer model proposed for Embrapa Pigs and Poultry

The proposed model was created from the studies made about the TT concepts, mechanisms and models, the TT process in public research institutions, the characteristics and structure of the broiler productive chain and the contribution of the public research for that chain.

The main assumption is to increase the interaction between the developers of the technology and the users, suggesting the technology as a result of a two-way interactive process (non-linear) with constant and simultaneous exchange of ideas between the involved individuals.



The proposal is based in the creation of an Observatory<sup>1</sup>, with strong interface in the centers that generate technological poultry innovations which are in the production and industrialization stages, where are located the companies of nutrition, genetics, health, machines and equipments and agricultural industries (Figure 1).



The model considers that Embrapa research activities are more strongly directed to production and industrialization stages, where there is an exchange of information between those agents. Thereby, starting from that interaction between the involved actors, the chain research demands would be identified in the observatory and transferred to Embrapa.

Is essential that the observatory team develops and keeps a strong and impartial interaction with the diverse links of the chain, with the objective of following the technological development and identify research demands. At the same time, must interact with the institution RD&I personnel, looking for alternatives, solutions and suggestions, before the identified demands.

The identified demands in the observatory are transferred to Embrapa which will evaluate the feasibility of the research under the optic of the mission, costs, competencies and time.

From those premises, the demands will be prioritized and transformed in research projects, which after the development and vali-

dation of the generated technologies, those will be transferred to the demanding users.

The adoption of that TT model will involve the use of the interactive innovation model, in other words, the definition of the project portfolio will be based in the demands pointed out by the chain. In that case, the TT role will no longer be the search for customers/users of the generated technologies, as they were developed to meet a specific demand or solve a specific problem of the user.

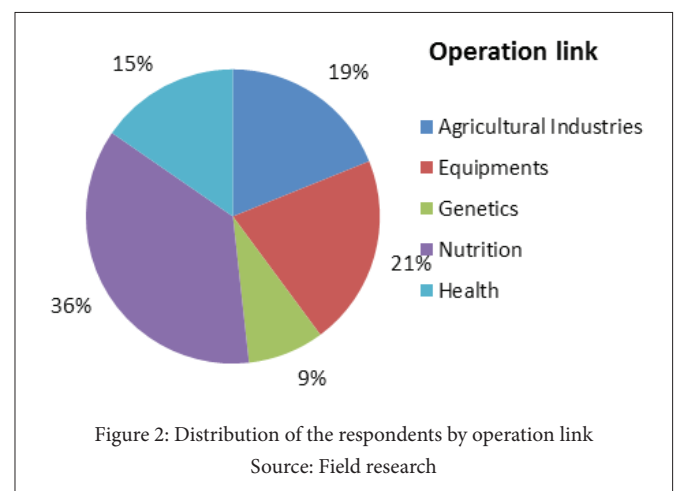
The new TT role of that model will be the consultation to customers, formalization of partnerships, distribution of *royalties* and technology patenting/licensing. That model proposes an interactive relationship between the links of the chain and the technical team and the leadership of Embrapa Pigs and Poultry. That approximation with the chain will allow knowing better the existing problems and discuss together the best form of solving them.

Thereby, knowing the problems of the chain and to develop practical solutions will help Embrapa to increasingly legitimate itself before the society.

## 7. Results

For a best understanding of the results, these will be presented in four subsections: characterization of the respondents and companies; relationship with IPPs; contribution of Embrapa to the chain; and validation of the model in fact demonstrates that, for being a part of the companies' strategic area, the surveyed public have knowledge of the addressed issue.

Most of the respondents work in the nutrition area (36.4%), while the smaller percentage works in the genetics area (9%). That fact is easily explained by the number of companies operating in those links, considering that the genetics companies are in a smaller number compared to the other segments (Figure 2).



(1) Observation device created by organizations, to follow the evolution of a phenomenon, domain or strategic issue, in time and space. In the origin of an observatory must exist a problematic that can be translated in the form of objectives, which allow defining indicators, which calculus needs the data integration and allows the execution of synthesis (FIEP, 2014).

Regarding the companies, 50.3% have international scope and 49.7% national scope. The link that has more companies with national scope is the agricultural industries link (due to the existence of a great number of small agricultural industries in Brazil), while most part of genetics companies (66.77%) have international scope.

Regarding location, most part of the companies is located in the South (48.25%) and southeast (46.85%) regions. Considering that the south region is the largest producer of broilers and that the southeast region is the largest Brazilian industrial center, this result was already expected. Only nutrition companies are present in all Brazilian regions. The rest are concentrated in the south and southeast regions, with exception of health and agricultural industries which also have companies in the central-west region.

Regarding the staff, 24.48% of the companies have a staff of up to 50 employees. The equipment (40%) and nutrition (32.70%) companies are the ones that have the largest percentage of small companies (up to 50 employees). The nutrition and agricultural industries companies have the largest percentage of big companies, with more than 5,000 employees.

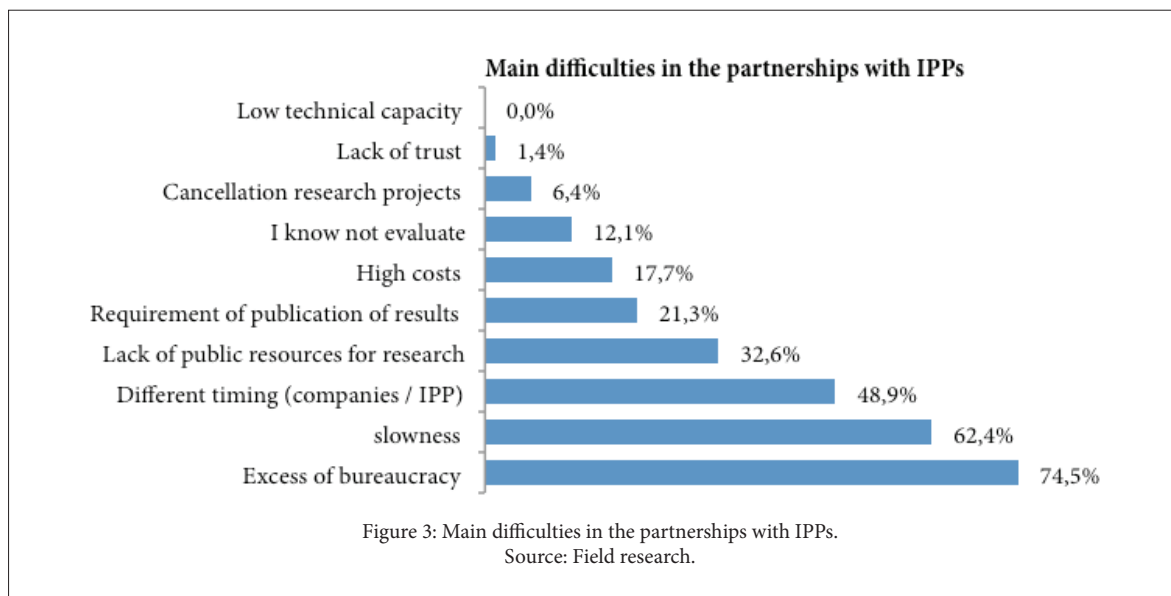
Those two factors were mentioned as main difficulties by the respondents of the agricultural industries (81.50% each), of equipments (82.50% and 65.50%), of nutrition (66.70% and 52.90%), of health (72.70% and 59.10%). The genetics link considers the excess of bureaucracy (75%), different timing between companies and IPPs (66.70%). Slowness was in third place for those companies (58.30%).

### Relationship of the chain with the Public Research Institutions

The Brazilian government created several public institutions, with the intention of solving the social problems and promoting new knowledge, look for the Country's technological independence, besides of streamline the information transfer, reducing the time between the technology generation and adoption. Several authors point out the need of a tightening of the relationship between the IPPs and the private sector, to work in a more integrated form in the search for efficient solutions for the presented problems.

To analyze the relationship of the chain with Public Institutions were elaborated two questions: Which are the main difficulties in the partnership with IPPs and which is considered the best form for the IPPs to develop efficient technologies for the chain.

The main difficulties in the partnerships with the IPPs pointed out by the group of respondents are the excess of bureaucracy (74.5%) and the slowness (62.4%), as demonstrated in Figure 3.



According to the interviewed group, the best form for the IPPs to develop efficient technologies for the chain is "To develop the technologies in partnership with the chain agents" (89.3%).

Bureaucracy is one of the largest obstacles for economic growth of Brazil, according to the research of Grant Thornton International (2010), being mentioned as the largest barrier for 37% of the entre-

preneurs, higher result than the world average (32%) and emerging countries average (31%).

Regarding slowness, Johnson (1996) affirms that the fact that property is public makes several processes more fragile, complex and slow, which can be simpler and more dynamic in the private organization, whose objectives are clearer and a smaller external control than the exercised in the public organization.

### The contribution of Embrapa Pigs and Poultry to the broiler productive chain

To analyze the contribution of Embrapa Pigs and Poultry to the broiler productive chain, were formulated questions about: Knowledge and use of developed technologies by the Unit, importance attributed to those technologies, Unit contribution degree to the chain, existence of a distancing between Embrapa and the chain, distancing degree, interaction forms of Embrapa with the chain, forms of identifying demands and orientation of the research efforts.

To know if the developed technologies by the Unit are known and used by the diverse links of the chain were selected five technologies for each link and requested that they mentioned which one of the technologies they know and the importance degree of those technologies.

**Agricultural industries:** From the total of 27 respondents, two did not know to evaluate. The rest mentioned the technologies: compost separator for composting of bird carcass, the thermal environmental conditioning of aviaries and broiler production cost calculus. Those three technologies were considered important by the respondents, which attributed importance degree ranged between 5 and 7, in a scale from 1 to 7.

**Equipments:** Among the 30 respondents, five did not answer the question. The rest mentioned two technologies: Curtain and light program for broilers, which attributed importance degree was 6 and the Thermal environmental conditioning of aviaries, with importance degree of 7.

**Genetics:** Of the 12 respondents, 2 did not answer the question. Of the respondents that answered, only 2 affirmed to know or use the technologies: Identification of the genomic regions in the chromosomes of the hen associated with characteristics of performance, carcass and weight of the organs (importance degree of 5), and Analysis of multiple characteristics for mapping of QTL in hens, with the interviewed not attributing importance degree.

**Nutrition:** From the total of the 52 respondents, only one did not answer that question. The most mentioned technologies are: Utilization of enzyme in diets based in corn and soy bran for broilers (degree 7) and the Chemical composition and values of metabolisable energy for broilers (degree 7).

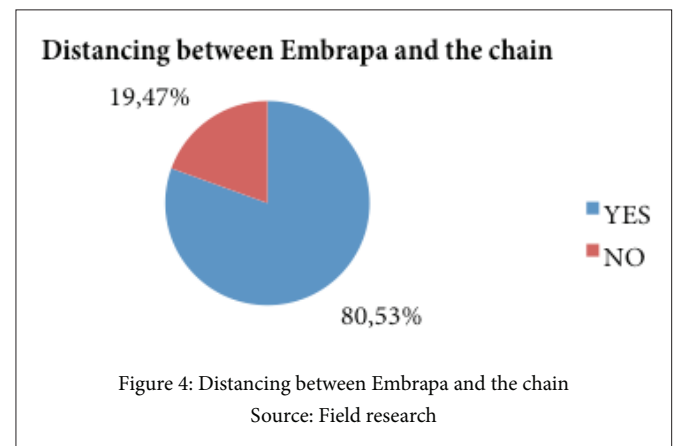
**Health:** Of the 22 respondents, seven did not answer that question, the rest only mentioned the technology Monitoring of bird serum, resistance to antimicrobials and genotypes of *Salmonella spp.*, isolated from commercial broiler aviaries, for which four attributed importance degree of 5.

For the respondents, the main functions of Embrapa Pigs and Poultry in the chain are: "To develop technologies to meet the specific demands of the chain" (71.63%) and "Applied Science sharing the gains of the innovation in the chain" (58.16%).

Regarding the contribution degree of the institution to the chain, there was not a cohesive opinion among the groups of respondents. The attributed contribution degree, in a scale from 1 (very low) to 7 (very high), ranged between three (8.13%) and seven (24.39%). For 21.95% of the respondents, the institution contribution degree is five, with the same percentage of respondents attributing a degree of 6 to that question. Among all the links, the contribution of Embrapa is more perceived by the nutrition link, where 30% of the respondents attributed a degree of 7 and 19% attributed a degree of 6.

The best forms for Embrapa to identify research demands are by means of the participation in events of the sector (73.05%), regular consultations to specialists and users of the technologies (65.96%) and the intensification of the interpersonal relationship (65.71%). Regarding the research efforts, 76.34% of the respondents believe that they must be directed to the production stage.

The existence of a distancing between Embrapa and the diverse links of the chain is perceived by 80.53% of the respondents (Figure 4).



Such distancing is more strongly perceived in the health link (94.4%). In the other links, the percentages ranged between 74.4% (Nutrition) and 77.8% (Genetics). To reduce the distancing and promoting a larger interaction with the chain, the institution must "Promote regular encounters with the companies to discuss the demands" (80.14%) and "To develop partnership research projects" (72.14%).

Analyzing the low rate of adoption of the generated technologies by the institution and the distancing existing between Embrapa and the diverse links of the chain, was perceived the need of looking for a new TT model which allows to promote a larger interaction with the chain to know its real demands and enable the joint development of applied technologies that meet those demands, thereby increasing the adoption rate of the generated technologies and, therefore, its legitimating before its users.

In this context, that research had the objective of proposing and validating a TT model that can meet those needs appointed by the re-

search. The proposed model was the creation of a Poultry Research Observatory. Next we will present the result of the validation of that model by the diverse links of the broiler productive chain.

### Validation of the proposed model

To validate the proposed model, we elaborated the following questions: Do you consider important the creation of an observatory as a form of identifying the demands of the chain and extend the interaction between Embrapa Pigs and Poultry and the chain; which would be the role of Embrapa Pigs and Poultry in that observatory; which would be the role of the companies in that observatories; which links of the chain must take part of the observatory; how the observatory may interact with the diverse links of the chain; the observatory must be formalized; Do you (or your company) will take part of the observatory.

The creation of the observatory was approved by 96.77% of the respondents. The approval rate in the agricultural industries and genetics companies was 100%. In the link of equipments, the approval percentage was 88.90%; in the link of Nutrition was 96.30% and in the link of Health 95%.

Regarding the role of Embrapa Pigs and Poultry in the observatory, for 86.4% of the respondents, the institution must coordinate the observatory. The companies, in turn, must participate (84.8%) and demand (56.8%) from the observatory.

The links of the chain that must have priority participation in the observatory are the agricultural industries (87.2%), nutrition companies (78.4%), health companies (73.6%), equipment companies (69.6%) and genetics companies (67.2%). Besides those companies, must also take part the research institutions (65.6%) and universities (62.4%).

The suggested form for interaction of the observatory with the diverse links of the chain was the execution of regular encounters with representatives of the links of the chain. (81.6%). Only the link of health suggested the use of an *online* interaction platform for doubts and suggestions (73.70%), as interaction form.

According to 99.17% of the respondents, the observatory must be formalized. Only 5.3% of the respondents of the link of health believe that there is no need for formalization.

There was also a great acceptance from the respondents in taking part of the observatory. From the total of respondents 96.77% were willing to participate. The participation rate of the links was as follows: Agricultural industries (96.30%), Equipments (96%), Genetics (88.90%), Nutrition (97.70%) and Health (100%).

### 8. Conclusion

The low adoption rate of the developed technologies by Embrapa Pigs and Poultry, according to the reviewed literature and the results of this survey, can be attributed, by the form how those results are transferred and by the possibility of the generated technology does not meets the demands of the chain.

In both cases, that result can be attributed to the lack of interaction between the institution and the technology users. The TT current model does not provide interaction mechanisms with the chain, to identify its demands, which may result in a poorly formulated research problem and, consequently in technologies without practical application.

The model proposed in this survey aims to increase the interaction between the technology developers and the users, suggesting the technology as a result of a two-way interactive process (non-linear) with constant and simultaneous exchange of ideas between the involved individuals. The TT role in that model will be the consultation to customers, formalization of partnerships, distribution of *royalties* and patenting/licensing of the technology. Such approximation with the chain will allow knowing better the existing problems and discussing together the best form of solving them. That way, knowing the problems of the chain and developing practical solutions will help Embrapa to increasingly legitimate itself before the society.

### References

- Atkinson, R., Beachy, R., Conway, G., Cordova, F., Fox, M. Holbrook, K., Klessig, D., McCormick, L., McPherson, P., Rawlings, H., Rapson, R. Vanderhoef, L., Wiley, J. & Young, C. (2003). Public Sector Collaboration for Agricultural IP Management. *Science*. 301(5630) 174-175.
- Bassi, N.S.S. & Silva, C.L. (2014). As estratégias de divulgação científica e transferência de tecnologia utilizada pela Empresa Brasileira de Pesquisa Agropecuária-Embrapa. *Interações* 15(2), 361-372.
- CEPEA - Centro de Estudos Avançados em Economia. (2015). Retrieved from: <http://cepea.esalq.usp.br/pib/>.
- Eldred, W. & Mcgrath, M. E. (1997). Commercializing new technology I. *Research Technology Management*, 40(1), pp.41-47.
- Empresa Brasileira de Pesquisa Agropecuária – EMBRAPA. (2015) Retrieved from: <http://www.embrapa.br/>. (2008). Secretaria de Gestão e Estratégia. *V Plano Diretor da Embrapa 2008-2011-2023*. Brasília, DF.
- Fujisaka, S. (1994). Learning from six reasons why farmers do not adopt innovations intended to improve sustainability of upland agriculture. *Agricultural Systems*, Barking, 46 (4), pp.409-425.
- Garnica, L. A. & Torkomian, A. L. V. (2009). Gestão de tecnologia em universidades: uma análise do patenteamento e dos fatores de dificuldade e de apoio à transferência de tecnologia no Estado de São Paulo, *Gest. Prod.*, São Carlos, 16(4), pp.624-638.
- Grant Thornton International. (2015). International Business Report. Focus on Brazil. Retrieved from: <http://www.grantthorntonibos.com/Reports/2010/index.asp>.
- Johnson, B. B. (1996). *Serviços públicos no Brasil: mudanças e perspectivas*. São Paulo: Edgard Blucher.

- Kim, L. (2005). *Da imitação à inovação: a dinâmica do aprendizado tecnológico da Coreia*. Campinas, SP: Unicamp, 388 p.
- Krieger, E. & Galembeck, F. (1996). A capacitação brasileira para a pesquisa. In Schwartzman, S., Bertero, C.O., Krieger, E. M. (Eds). *Ciência e tecnologia no Brasil: A capacitação brasileira para a pesquisa científica e tecnológica* (pp.1-18). Rio de Janeiro; Editora da Fundação Getúlio Vargas.
- Pineiro, Martin. (2007). *Agricultural technology transfer to developing countries and the public sector*. Retrieved from: <file:///D:/perfil/Documents/Documentos%20outro%20perfil/bibliografia%20por%20assunto/foresight/Agricultural%20technology%20transfer%20to%20developing%20countries%20and%20the%20public%20sector.htm>
- Povoa, A, L.M.C. (2008). Patentes de universidades e institutos públicos de pesquisa e a transferência de tecnologia para empresas no Brasil (Tese de doutorado). Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brasil.
- Schaun, N. M. (1981). *Difusão de tecnologia no Centro Nacional de Milho e Sorgo*. Sete Lagoas: EMBRAPA CNPMS, 27 p.
- Schwartzman, S. (1996). Ciência e Tecnologia no Brasil: A capacitação brasileira para a pesquisa científica e tecnológica. Rio de Janeiro. *Fundação Getúlio Vargas*, pp.287-320.
- Tagliari, P. S. (1984). *Analysis of the communication linkages between the research and extensions agencies and evaluation of the research publications in the State of Santa Catarina, Brazil*. 1984. 207 p. M.Sc. thesis (Master of science agricultural journalism) – University of Wisconsin, Madison, 1984.
- Wildner, L. P., Nadal, R. & Silvestro, M. (1993). Metodologia para integrar a pesquisa, a extensão rural e o agricultor. *Agropecuária Catarinense*. Florianópolis, 6 (3), pp.37-47.



# Business Incubators in Brazil: Main Gaps to Be Explored by Academic Researchers

Gustavo Tietz <sup>1</sup>, Rosley Anholon <sup>1</sup>, Robert Eduardo Cooper Ordoñez <sup>\*1</sup>, Osvaldo Luis Quelhas <sup>2</sup>

**Abstract:** The business incubators have an essential role at any global entrepreneurial ecosystem. Through the support offered to entrepreneurs in terms of infrastructure and management, they reduce mortality risk of startup companies and contribute to better performance of the country's economy. In order to make a contribution to the academia and to business incubators, this paper is primarily engaged in performing a literature review on Brazilian and international academic basis in order to identify which are the main themes of research conducted involving Brazilian business incubators. The results show that most of the themes are associated with the services provision by the incubators and its management; however, there are many gaps yet to be explored by academic researchers, such as internal characteristics or the interrelationship between business incubators and triple helix.

**Keywords:** administration; management; business incubators; literature review; innovation; entrepreneurship; themes to be explored by academic researchers.

Submitted: June 29th 2015 / Approved: December 1st 2015

## 1. Introduction

According to the Global Entrepreneurship Monitor data (GEM), nowadays Brazil is well-known as one of the most entrepreneurial countries in the world, holding an Entrepreneurial Activity Rate (EAR) of approximately 17.2% (GEM, 2014). According to GEM, the EAR can be defined as the total number of individuals between 18 and 64 years who are starting a new business.

Of course, in an entrepreneur ecosystem it coexist all types of entrepreneurs, from the one who is starting a venture without structure to the one that, on the positive end, has an innovative idea which could revolutionize the guidelines of an economic segment. Perhaps for this last group, much more structured than the first one, the difference between failure and success resides in the aid and support provided by specialized agencies that assist entrepreneurs in suppressing their deficiencies and minimizes the risks associated with the entrance into highly competitive markets. This is precisely the main business incubator function.

According to ANTROPEC (2015), "the business incubator aims to support entrepreneurs so that they can develop new ideas and turn them into successful enterprises. For this, it offers infrastructure and management support, guiding them on business management and competitiveness, among other key issues for the development of a company."

According to the latest study conducted by the National Promoting Innovative Ventures Entities Association in partnership with the Ministry of Science, Technology and Innovation, currently Brazil has 384 incubators in operation (ANPROTEC, 2011), a number considered low when compared to the economy's size. Worldwide, the total

number of these entities is almost 5,000 and about half of them located in Europe and United States (900 units are located in Europe and 400 units in USA according to Bruneel et al. (2012) and Cooper et al. (2012).

Despite of the small proportion of Brazilian business incubators in relation to global data, the entities located here present interesting economic indicators to be better explored. According to the ANPROTEC (2012), Brazil has 2,640 incubated companies, 2,509 graduated companies, 1,124 member companies, 45,599 jobs resulting from the activities of the incubators and gross sale of the order of \$ 5 billion real. Other data indicate that the importance of business incubators can be found in the paper by Anholon & Silva (2015), which also show the importance and necessity of the incubator program expansion in Brazil.

In this context the following questions arise: how is it possible to maximize the business incubator program in Brazil? What are the current critical processes that can be improved? What are the management errors to be improved? There are many questions to be answered and the academia, through well-structured research in management, can provide valuable answers.

In order to make a contribution to academia and to the topic of business incubators, this paper will developed a literature review to answer the following question: "Which are the main themes addressed by academic research related to the incubation process involving Brazilian entities and what are the potential issues to be better explored?"

In order to answer this question, the following objectives were unfolded: 1) analyze the main Brazilian and international scientific bases looking for papers related to Brazilian business incubators; 2)

<sup>1</sup> School of Mechanical Engineering, Department of Manufacturing Engineering and Materials, State University of Campinas. São Paulo. Brazil.

<sup>2</sup> Department of Post-Graduation on Production Engineering, Fluminense Federal University. Rio de Janeiro. Brazil.

\*Corresponding author: cooper@fem.unicamp.br



perform the screening of paper related to business incubators on research in Brazil, analyze and classify the results and 3) establish conclusions on the main issues addressed and point out the gaps to be further explored by academia.

## 2. Literature Review

### 2.1 Definitions and concepts related to business incubators

Business incubators are organizations which promote innovative projects. According to ANTROPEC (2015), “the business incubator aims to support entrepreneurs so that they can develop new ideas and turn them into successful enterprises. In order to reach this objective, it offers infrastructure and management support guiding entrepreneurs on the business management, competitiveness and other key issues related to the development of a company”.

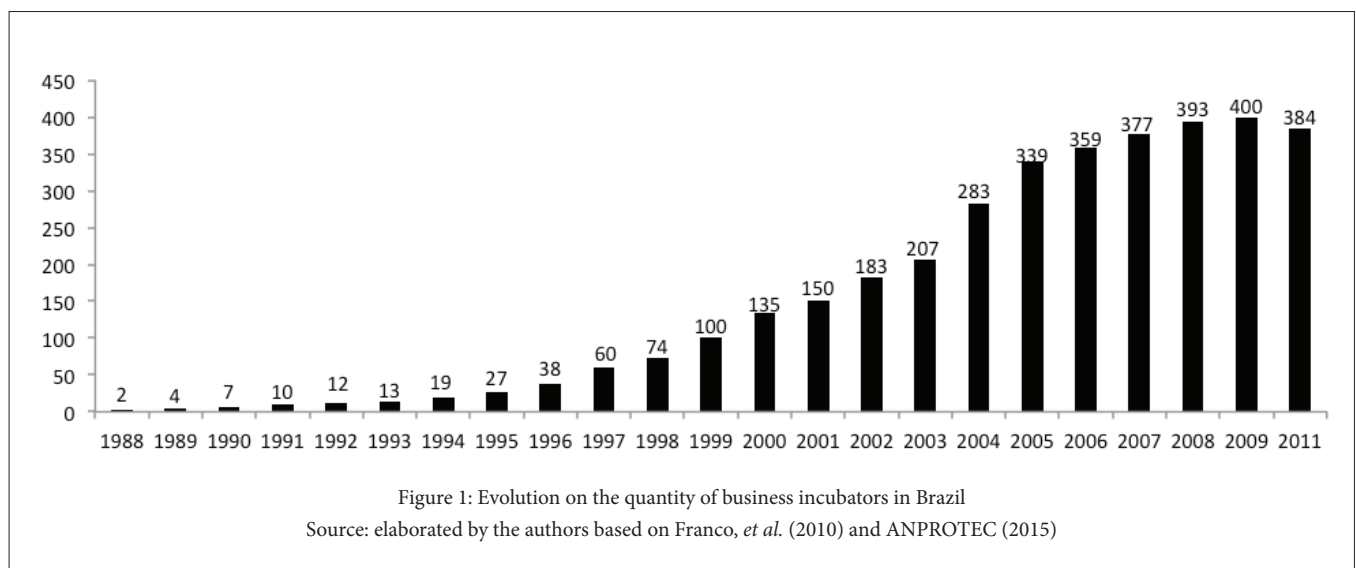
According to the *National Business Incubation Association* (NBIA, 2015), incubators are organizations that promote the development of entrepreneurial companies, helping them to survive and develop during the initial phase, when they are most vulnerable. Through assessments, guidelines and consultancies, among other activities, it is

created an environment which enables the start-ups strengthening (Jeffrey, 2013).

In Brazil the first incubators emerged in the 80's - the first incubator was created in 1982 in São Carlos (SP) by the High Technology Park Foundation, as presented by Lahorgue (2004). Until 1987, there were few incubators operating in Brazil according to Franco *et al.* (2010).

The consolidation of the business incubators importance in Brazil occurred in 1987 with the creation of the ANPROTEC whose mission is to represent and defend the interests of incubators and technology parks, stimulating the creation and strengthening the knowledge-based companies. (Miziara & Carvalho, 2008 *apud* Sousa & Beuren, 2012). It is from this year that began the process of business incubators implementation in Brazil began, according to Medeiros & Atas (1995).

The Figure 1 shows the evolution of the number of business incubators in Brazil since 1988, taking into account data informed by Franco *et al.* (2010) and ANPROTEC (2015). It is important to mention that the available data in the literature starts in 1988 and ends in 2011. Also, the year of 2010 is omitted in the Figure 1 because no data was found in the literature for this specific year.



According to Souza & Beuren (2012), the main advantages of a company being supported by an incubator are the available infrastructure (services and resources), the quality of incubator services and access to development institutions. Regarding the disadvantages, most companies do not perceive any loss by participating in an incubation program, however, some of them mentioned difficulties in establishing cooperation and partnership with other incubated companies, difficulties in obtaining resources, funding and loans via incubator. Excessive self-protectionism from incubators' management was also mentioned a few times.

The period in which a company remains incubated, called incubation process, is divided into phases each one with distinct characteristics

and features (Raupp & Beuren, 2011). The number of phases and its corresponding names vary according to the referenced author. Medeiros & Atas (1995) presents four stages associated with incubating process: enterprise deployment in an incubator, growth, maturation and consolidation. Russi Junior (1999) details the process in five phases: establishment of the company and commencement of the operations, product or service launch, growth, maturation, consolidation and program shutdown.

According to Moreira (2002), the phases of the incubation process are:

selection phase: it is the selection of the project to be installed in the incubator;

- incubation phase: this phase is the formalization of the incubation and enterprise installation;
- development phase: the incubated company starts the development of their business strategies, planning activities, control of resources, among other factors. The resources are allocated to the development of the product or service, involving testing and prototyping. It is the most challenging phase of the incubation process;
- growth phase: It represents the expansion of the elements defined in the previous phase. The company will look for expanding trade, gaining new market shares or new consumer markets.
- liberation phase: the company is ready to leave the incubator. The turnover has reached a level which allows the company to migrate to a new physical host.

In addition to the incubation process, Zouain & Silveira (2006) presents other three processes developed by an incubator:

- pre-incubation process: It develops initiatives related to improving the quality and increasing the number of candidates for incubation programs;
- monitoring the graduated companies: it is the periodic analysis of the companies which are already graduated by the incubator and the measurement of its economic, social and technological impact;
- capture process: it is related to projects that aim to on capture financial resources from development institutions or funding agencies – from its preparation to its execution and monitoring.

Finally, Chandra & Fealey (2009) compares the incubation models in Brazil, China and USA in terms of adopted policies and practices. Although there are similarities in relation to features such as infrastructure provision and access to development finance institutions, there are differences in strategic focus, funding sources, types of incubators and government intervention in incubators. Table 1 presents this comparison in details.

Characteristic	Brazil	China	USA
Strategic focus	Foster entrepreneurship, economic development, job creation and technology commercialization	Social and economic mission	Economic development, technology transfer and commercialization
Sponsorship / Incubation Funding	Government., universities and some private funds	Government	Multiple levels of government, economic development organizations and private funding
Type of incubated business	High-tech, mixed in social, culture and design incubators	Mostly high-tech	Mixed, high-tech and specialized
Service mix	Both hard and soft services	Mostly tangible service of administrative nature	Tangible and specialized, value adding services
Financial services	Links to various sources of govt., funding lines, angels and VCs	Links to various sources of govt., grants, bank loans and some VC funding	Links to sources of financing with a few investing directly in incubates
Role of government	Visible, carrot and stick, synergistic approach	High – visible hand	Low supportive, but not dictatorial

Table 1. Incubation models in Brazil, China and USA. Source: Chandra & Fealey (2009)

### 3. Methodology

#### 3.1 Scientific Research Classification

The classification of this scientific research follows the classical criteria. From the perspective of methods, this research presents deductive characteristics because it analyzes papers published in scientific bases and deduces conclusions based on this information. According to Lakatos & Marconi (2003), the deduction allows conclusions from true premises. To Silva & Menezes (2005), the deduction aims to explain the content of assumptions and facts through reason. Based on

Andrade (1999), this method was firstly introduced by René Descarte for which the only way to find a certainty is through the reason – the absolute principle of human knowledge.

Regarding the technical procedures this research can be classified as bibliographic because it employs materials already developed and published mainly books and scientific papers. According to Gil (2002) and Lakatos & Marconi (2003), the bibliographic research covers the entire literature already published in relation to the subject of study. Its purpose is to put the researcher in direct contact with all that has been written, said or filmed about the subject of study.

Considering the approach of the research question, this research is classified as a qualitative one since it owns a sequence of activities involving data reduction, categorization, interpretation and final conclusion. According to Gil (2002), this procedure represents a qualitative study. As per Silva & Menezes (2005), interpreting the data and assigning meanings to it is essential in the qualitative research process which does not require the use of statistical methods. Based on Godoy (1995), the qualitative research does not attempt to enumerate the events studied nor employs statistical instrumental in analyzing the data base.

Regarding the nature of this research, it is classified as applied. According to Silva & Menezes (2005), applied research is the one which generates knowledge for practical application and aims on solving specific problems.

Finally, in regards to the objective it is classified as exploratory. According to Gil (2002), the exploratory research aims on the improve-

ment of ideas or on the discovery of intuitions in order to provide greater familiarity with the studied question.

### 3.2 Research Method

This scientific research consists in a review of the literature related to the theme business incubator in Brazil, highlighting the main issues surveyed. The investigated scientific bases were the Web of Science, SciELO and Periódicos Capes. It was also carried out specific research related to events and seminars at the ANPROTEC website. The terms used for the search in the scientific bases were “*incubadora de empresas*” combined with the word “*Brasil*” and their translations into English “*business incubators*” and “*Brazil*”.

Initially it forty (40) papers were found, however, the sample to be studied consisted in thirty three (33) papers after deleting the duplicates. The themes addressed in these papers were identified and classified according to the categories presented in Table 2 which considers the phase's division mentioned by authors in the literature.

Group 1: MAIN PROCESS. Source: Moreira (2002), Raupp & Beuren (2011), Zouain & Silveira (2006)	
1.1 Pre-Incubation Process	
1.2 Incubation Process	11.2.1 Selection
	11.2.2 Incubation
	11.2.3 Development
	11.2.4 Growth
	11.2.5 Liberation
1.3 Monitoring the graduated companies	
1.4 Capture process	
Group 2: GENERAL CHARACTERISTICS. Source: Chandra & Fealey, (2009)	
2.1 Internal characteristics	2.1.1 Strategic Focus
	2.1.2 Type of Incubated Business
	2.1.3 Role of government
	2.1.4 Management (personnel, information)
	2.1.5 Quantity and geographical location
2.2 Interrelationship between incubators	
2.3 Relationship between incubators and external environment	2.3.1 Services
	2.3.2 Triple helix

Table 2. Categories by themes used to classify papers. Source: elaborated by the authors

In order to clarify the items presented in the general characteristics (Group 2 of Table 2), below there is a brief description of each item.

- Internal characteristics (2.1): this item refers to papers whose themes were about the internal environment characteristics of a business incubator;
- Strategic focus (2.1.1): It includes papers which discuss the scope of the business incubator's action. As an example, it is possible to mention the definition and selection of the market, customers and business strategies;
- Type of incubator (2.1.2): this item corresponds to researches which are about the business incubators types (technological, traditional, mixed, cooperative, private and others);
- Role of government (2.1.3): It refers to papers which discuss the influence and impact of the government on business incubators;
- Management (personnel, information) (2.1.4): this item corresponds to papers which investigate the proper way to manage a business incubator;
- Quantity and geographical location (2.1.5): It refers to papers which are about the evolution on the number of business incubators in Brazil, their locations and regional distribution;

- Interrelationship between business incubators (2.2): It includes papers which deal with both the relationship between national incubators and also the relation between national and world-wide incubators.
- Relationship between the incubators and external environment (2.3): It refers to papers which investigate the characteristics related to the external environment of a business incubator;
- Services (2.3.1): It refers to papers which are about the quality of services provided by business incubators and their contribution to the incubated companies;

- Triple helix (2.3.2): It corresponds refers to papers which argue about with the impact of the triple helix (interaction among university, industry and government) in business incubators.

#### 4. Results and Discussion

As presented on the item Research Method item (3.2), after the first screening there were thirty three (33) papers remaining. These papers were classified based on their themes and the result of this analysis is presented at Table 3.

Item	Reference	Theme / Subject	Journal or Magazine
1	Andrade Junior (2012)	Evaluate the Brazilian experience on overcoming the difficulties of technology-based companies in incubators in order to propose improvement actions using incubators in Brazil as a reference.	<i>Journal of Technology Management &amp; Innovation</i>
2	Anholon & Silva (2015)	Analyze the management system developed by the reference business incubator Business Center to Develop Advanced Technologies – CELTA, from the CERTI Foundation, located in Florianopolis (SC), in order to identify the features which lead to success.	Revista Geintec
3	Barquette (2002)	Examine the locational issues concerning technological incubators and high tech firms, trying to identify what are the most relevant factors for their creation and development.	Revista de Administração de Empresas (RAE)
4	Chandra & Fealey (2009)	Describe the incubation landscapes of the United States, China and Brazil indicating the similarities and differences in incubation approaches between the three countries.	<i>International Journal of Entrepreneurship</i>
5	Engelman <i>et al.</i> (2011)	Assess the quality of services provided by a business incubator, based on comparisons between the perceptions of business managers of incubated firms and the of the coordination of a multi sector technology based incubator.	Revista Eletrônica de Administração
6	Engelman & Fracasso (2013)	Verify how Brazilian technology incubators contribute to the internationalization of incubated companies from the point of view of their management.	Revista de Administração
7	Etzkowitz <i>et al.</i> (2005)	Analyze the evolution of Brazilian incubators considering the triple helix concept ( <i>meta-innovation system</i> ).	<i>Research Policy</i>
8	Ferreira <i>et al.</i> (2008)	Present a proposal management from through performance indicators to technological based enterprises in development and growth.	Produção
9	Fiates <i>et al.</i> (2013)	Analyze the characteristics of the internationalization of small and medium-sized technology-based companies, incubated and graduated ones in order to identify the role of incubators in the process.	Revista Eletrônica de Estratégia & Negócios
10	Fonseca & Martins (2010)	Contribute to academic reflections on the role of business incubators as institutional agents to promote environmental performance by small firms.	Produção
11	Fonseca & Jabbour (2012)	Review the literature on green management and smaller enterprises, business incubator performance and the greening of business incubators.	<i>Technovation</i>
12	Franco <i>et al.</i> (2010)	Analyze the evolution on the number of incubators of Brazilian enterprises and sweats regional distribution.	Locus Científico
13	Gallon <i>et al.</i> (2009)	Describe the relationships network and identify the importance of these relationships to the organizational performance of small incubated ITBs in the perception of the entrepreneurs.	Revista de Gestão da Tecnologia e Sistemas de Informação
14	Gaspar (2008)	Analyze the influence of venture capital and business incubation on the decision to create new companies and in their success, that is, in the survival of the startups.	Revista Portuguesa e Brasileira de Gestão

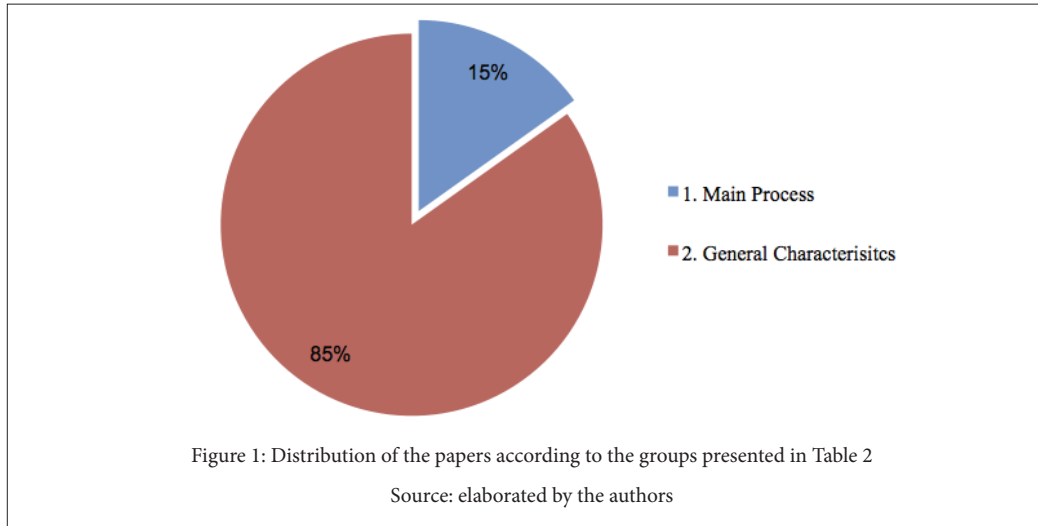


Item	Reference	Theme / Subject	Journal or Magazine
15	Gonçalves & Freire (2007)	Analyze the process of information communication (information transfer and its transformation into knowledge) in a technological incubator at the Gênesis Institute of Pontifícia Universidade Católica (PUC) located in Rio de Janeiro.	Ciência da Informação
16	Gurgel (2007)	Show the importance of incubators to the creation and implantation of lasting and healthy companies, as well as for the overcoming of the high index of companies' mortality.	Revista Ibero-Americana de Estratégia
17	Iacono et al. (2011)	In light of the new innovation paradigm (interactive nature of innovation), evaluate the cooperation and interaction of based-technology incubators enterprises.	Revista de Administração Pública (RAP)
18	Leca et. al (2014)	Present the challenges and contributions of the academic area to the worker cooperatives incubators.	Organization
19	Potrich et al. (2013)	Characterize the information security management on the context of incubated and graduated companies of the Technology Incubator of Santa Maria (ITSM).	Revista GEINTEC
20	Raupp & Beuren (2011)	Outline the profile of the support offered by the Brazilian incubators to the incubated companies.	Revista Eletrônica de Administração
21	Ribeiro et al. (2005)	Generate understanding about the role of government in promoting technological innovation an incubator of companies. Case study performed in the municipal district of Santa Rita do Sapucaí (MG).	Cadernos EBAPE.BR
22	Robinson (2010)	Propose a three stage model of the development of business incubation practices in emerging markets.	Journal of Technology Management & Innovation
23	Shin & Lamy (2006)	Examine paths of commercial learning in incubators based on the scientist-entrepreneurs vision which represents the acme of strong science and enterprise interaction.	Scientiezudia
24	Silva et. al. (2009)	Identify and explain similarities and differences in characteristics of entrepreneurs at incubators in Brazil and Portugal.	Revista de Administração Contemporânea (RAC)
25	Silva et al. (2012)	Evaluate the relationship between the functions performed by managers and the results obtained by the incubator.	Produção
26	Silveira & Bazzo (2009)	Expose the conception that entrepreneurs and managers involved with incubators have about science, technology, innovation and their relations in the social context.	Ciência & Educação
27	Sousa & Beuren (2012)	Highlight the relevance of the services and resources available at an incubator, as well as identify the expectations perceived by the entrepreneurs in the incubation process.	Revista GESTÃO.Org
28	Van Hemmen et al. (2013)	Demonstrate the relationship between charismatic leadership and entrepreneurship, which play a key role in the development of business incubators.	Innovar
29	Veloso Filho & Nogueira (2006)	Obtain data and identify relevant local or regional technological promotion and innovation systems in Brazil.	Interações
30	Xavier et. al (2008)	Analyze the contribution of business incubators for small IT business. A study case and deep research was developed in three Brazilian IT incubators.	Revista de Gestão da Tecnologia e Sistemas de Informação
31	Zimmermann et al. (2009)	Analyze economic and innovative aspects of small technologic companies incubated at the Business Center to Develop Advanced Technologies (CEL-TA) located in Florianópolis (SC).	Análise
32	Zouain & Silveira (2006)	Stress the importance over the past few years of the incubators movement in Brazil and underscore the need, on the part of incubators, to adopt management models that are more relevant to the Brazilian reality.	Cadernos EBAPE.BR
33	Zouain & Torres (2005)	Analyze innovations in work relationships allegedly to be found in Brazilian incubators.	Cadernos EBAPE.BR

Table 3. Papers analyzed after the first screening. Source: elaborated by authors.

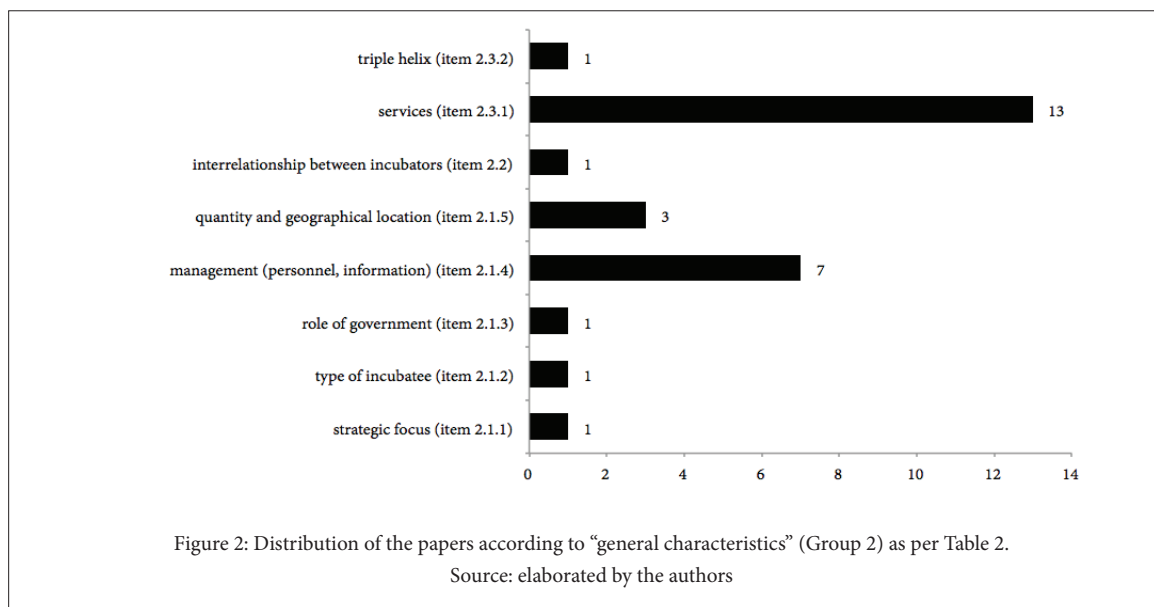
Based on the database above, a first classification according to the groups presented in Table 2 was elaborated and the results are presented on Figure 1. It shows that 15% of the papers have their themes associated with “main process” (Group 1) and 85% of the papers have their themes associated with “general characteristics” (Group 2), which demonstrate a high possibility of researches

which can be developed in Group 1. In numbers, the Group 1 has only five (5) papers and the Group 2 has twenty eight (28) papers. In this scenario, it is important to mention Zouain & Silveira (2006), who claim that the “main process” (Group 1) has a strict relation with the efficiency of an incubator to turn incubates into successful companies.



Specifically for papers associated with “main process” (Group 1), five (5) papers are connected with the “incubation process” (item 1.2). Four (4) papers were related to “development” (item 1.2.3) and one (1) paper was associated with “growth” (item 1.2.4). Regarding the other topics presented in Group 1 no studies have been found published in scientific papers, which shows the great potential for researchers to explore these themes. Additionally, Zouain & Silveira (2006) highlights the high importance of the “pre-incubation process” (item 1.1), the “selection” (item 1.2.1) and “monitoring the graduated companies” (item 1.3) to the success of an incubation program, corroborating the need for researches and management innovation in these areas.

Regarding the twenty eight (28) papers related to the “general characteristics” (Group 2), the researched themes are distributed as follows: one (1) paper associated with “strategic focus” (item 2.1.1), one (1) paper for “type of incubated business” (item 2.1.2); one (1) item related to “government role” (item 2.1.3), seven (7) papers for “management (personnel, information)” (item 2.1.4), three (3) papers associated with “quantity and geographical location” (item 2.1.5), one (1) paper related to the “interrelationship between incubators” (item 2.2), thirteen (13) papers related to “services” (item 2.3.1), and one (1) paper associated with “triple helix” (item 2.3.2). Figure 2 presents all this data in a graphic.



Based on the above figure, it can be noted the need for a greater number of scientific researches related to the “strategic focus” (item 2.1.1), the “type of incubated business” (item 2.1.2), the “role of government” (item 2.1.3), the “interrelationship between incubators” (item 2.2) and “triple helix” (item 2.3.2). According to Anholon & Silva (2015), when analyzing the CELTA incubator in Florianópolis – Santa Catarina, all of these items are extremely important to the success of an incubation program.

Among all the items above, the authors of this papers highlight the urgent need for further research about the “triple helix” (item 2.3.2), or in another words, about the interrelation of incubators with universities, government and companies. According to Chandra & Fealey (2009), in other countries like China and US the interfaces between the groups mentioned are better developed and more mature than those ones observed in the Brazilian incubation program.

The greatest amount of researches was associated with “services” (item 2.3.1), which addresses the work offered provided by the incubators. Besides the quality of the services provided, these researches also discuss current themes such as sustainable practices, self-financing of incubators and consultancy provided by incubators to companies regarding their internationalization.

## 5. Conclusion

As mentioned above, this paper was engaged in the analysis of the main bases of national and international scientific data in order to identify the most important themes of research associated with to the incubation program for Brazilian companies. The search in scientific bases enabled the finding of thirty three (33) papers which were analyzed and divided into categories structured according to the authors Moreira (2002), Zouain & Silveira (2006), Raupp & Beuren (2011) and Chandra & Fealey, (2009).

In light of the results found, it was possible to answer the proposed question issue. The main researched theme on Brazilian incubators is related to their characteristics, primarily the provided services and secondarily the management (personnel, information). This topic presented a significant higher number of scientific researches than any other themes which had one, at maximum, four published works.

The conclusion is that there are many areas to be explored in scientific research, which can provide positive results to the Brazilian incubation program. For the “main process” (Group 1) the gaps to be explored by researchers are noticed in all items. For the “general characteristics” (Group 2) the gaps to be explored by researchers are mainly perceived in the “internal characteristics” (item 2.1), “interrelationship between incubators” (item 2.2) and “triple helix” (item 2.3.2).

Thus, it is expected that the results and conclusions presented in this paper can be valuable to both the academia and the business incubators as a starting point for further research to provide better results to the Brazilian incubation program.

## 6. References

- Andrade Junior, P.P. (2012). The Brazilian experience in overcoming difficulties of technology-based companies in incubators. *Journal of Technology Management & Innovation*, 7, 161-171. <http://dx.doi.org/10.1590/S0103-65132013005000085>
- Andrade, M. M. (1999) *Introdução a Metodologia do Trabalho Científico*. 4 ed. São Paulo. Atlas.
- Anholon, R. Silva, M. C. (2015). Diferenciais do sistema de gestão desenvolvido por uma incubadora de empresas de referência: o caso do CELTA Florianópolis. *Revista GEINTEC*, 5, 1864-1880. <http://dx.doi.org/10.7198/S2237-0722201500010021>
- ANPROTEC (2015). Associação Nacional de Entidades Promotoras de Empreendimentos Inovadores. Incubadoras de Empresas e Parques Tecnológicos. Available on <http://anprotec.org.br/site/pt/incubadoras-e-parques> Access February 01, 2015.
- ANPROTEC (2012). Ministério da Ciência, Tecnologia e Inovação (MCTI). Estudo, Análise e Proposições sobre as Incubadoras de Empresas no Brasil: relatório técnico. ANPROTEC, 24 p., 2012.
- Barquette, S. (2002). Fatores de localização de incubadoras e empreendimentos de alta tecnologia. *Revista de Administração de Empresas (RAE)*, 42, 101-113. <http://www.scielo.br/pdf/rae/v42n3/v42n3a09.pdf>
- Bruneel, J.; Ratinho, T.; CLARYSSE, B.; GROEN, A. (2012). The evolution of business incubators: comparing demand and supply of business incubation services across different incubator generations. *Technovation*, 32, 110-112. <http://dx.doi.org/10.1016/j.technovation.2011.11.003>
- Chandra, A. Fealey, T. (2009). Business incubation in the United States, China and Brazil: a comparison of role of government, incubator funding and financial services. *International Journal of Entrepreneurship*, 13, Special Issue, 67-86.
- Cooper, C.; Hamel, S.; Connaughton, S. (2012). Motivations and obstacles to networking in a university business incubator. *The Journal of Technology Transfer*, 37, 433-453. <http://dx.doi.org/10.1007/s10961-010-9189-0>
- Engelman, R.Fracasso, E. M. Brasil, V.S. (2011). A qualidade percebida nos serviços de incubação de empresas. *Revista Eletrônica de Administração*, 17, 802-822. <http://dx.doi.org/10.1590/S1413-23112011000300009>.
- Engelman, R. Fracasso, E. M. (2013). Contribuição das incubadoras tecnológicas na internacionalização das empresas incubadas. *Revista de Administração*, 48, 165-178. <http://dx.doi.org/10.5700/rausp1080>
- Etzkowitz, H. Mello, J.M.C. (2005) Almeida, M. Towards “meta-innovation” in Brazil: The evolution of the incubator and the emergence of a triple helix. *Research Policy*, 34, 411-424. <http://dx.doi.org/10.1016/j.respol.2005.01.011>

- Ferreira, M. P. Abreu, A. F.; Abreu, P. F.; Trzeciak, D. S.; Apolinário, L. G.; da Cunha, A. d'Ávila. (2008). Gestão por indicadores de desempenho: resultados na incubadora empresarial tecnológica. *Produção*, 18, 302-318. <http://dx.doi.org/10.1590/S0103-65132008000200008>
- Fiates, G. G. S. Martins, C.; Fiates, J. E. A.; Martignago, G.; Dos Santos, N. (2013). Análise do papel da incubadora na internacionalização de empresas de base tecnológica, incubadas e graduadas. *Revista Eletrônica de Estratégia & Negócios*, 6, 252-274. <http://www.portaldeperiodicos.unisul.br/index.php/EeN/article/view/929/1097>
- Fonseca, S. A. Martins, P. S. (2010). Gestão ambiental: uma súplica do planeta, um desafio para políticas públicas, incubadoras e pequenas empresas. *Produção*, 20, 538-548. <http://dx.doi.org/10.1590/S0103-65132010005000056>
- Fonseca, S. A. Jabbour, C. J. C. (2012). Assessment of business incubators' green performance: A framework and its application to Brazilian cases. *Technovation*, 32, 122-132. doi:10.1016/j.technovation.2011.10.006
- Franco, J. Pereira, M. F. Oshita, M. G. B.; Uchida, K. K. (2009) Evolução do número de incubadoras de empresas no Brasil e sua distribuição regional: uma análise através do modelo log-linear de taxas de crescimento. *Locus Científico*, 3, 107-114.
- Gallon, A. V. Ensslin, S. R.; Silveira, A. (2009). Rede de relacionamentos em pequenas empresas de base tecnológica (EBTs) incubadas: Um estudo da sua importância para o desempenho organizacional na percepção dos empreendedores. *Revista de Gestão da Tecnologia e Sistemas de Informação*, 6, 551-572. <http://dx.doi.org/10.4301/S1807-17752009000300009>
- Gaspar, F. (2008). Fomentar o empreendedorismo através do capital de risco e da incubação de empresas. *Revista Portuguesa e Brasileira de Gestão*, Jul/Set 2008, p. 71-84. <http://www.scielo.gpeari.mctes.pt/pdf/rpbgv/v7n3/v7n3a08.pdf>
- GEM. (2014). Global Entrepreneurship Monitor. Global Report. Babson College. Available at <http://www.gemconsortium.org/docs/3616/gem-2014-global-report> Acess April 2, 2015.
- GIL, A. C. (2002). Como Elaborar Projetos de Pesquisa. São Paulo: Atlas.
- Godoy, A. S. (1995). Introdução À Pesquisa Qualitativa E Suas Possibilidades. *Revista de Administração de Empresas (RAE)*, 35, 57-63. <http://rae.fgv.br/rae/vol35-num2-1995>
- Gonçalves, M. Freire, I. (2007). Processo de comunicação da informação em empresas de uma incubadora tecnológica. *Ciência da Informação*, 36, 16-26. <http://revista.ibict.br/ciinf/index.php/ciinf/article/view/951>
- Gurgel, P. N. A. (2007). Incubadora de empresas como suporte para as organizações que aprendem. *Revista Ibero-Americana de Estratégia*, 3, 101-120. <http://revistaiberoamericana.org/ojs/index.php/ibero/article/view/55>
- Iacono, A. Almeida, C. A. S. Nagano, M. S. (2001). Interação e cooperação de empresas incubadas de base tecnológica: uma análise diante do novo paradigma de inovação. *Revista de Administração Pública (RAP)*, 45, 1485-1516. <http://dx.doi.org/10.1590/S0034-76122011000500011>
- Jeffrey, M. S. (2013). Small business incubators in the USA: a historical review and preliminary research findings. *Journal of Knowledge-Based Innovation in China*, 5, 213-233. <http://dx.doi.org/10.1108/JKIC-07-2013-0013>
- Lakatos, E. M. Marconi, M. A. (2003). Fundamentos de Metodologia Científica. 5ª ed. São Paulo: Atlas. 2003. 311 pgs.
- Lahorgue, M. A. (2004). Pólos, parques e incubadoras: instrumento de desenvolvimento do século XXI. Brasília: Evangraf.
- Leca, B. Gond, J. P.; Cruz, L. B. (2014). Building 'Critical Performativity Engines' for deprived communities: The construction of popular cooperative incubators in Brazil. *Organization*, 21, 683-712. <http://dx.doi.org/10.1177/1350508414534647>
- Miziara, G. N.; Carvalho, M. M. (2008). Critical Success Factors in Business Incubators of Software. *Production online*, 3, 1-20. <http://dx.doi.org/10.14488/1676-1901.v8i3.131>
- Medeiros, J. A.; Atas, L. (1995). Incubadoras de empresas: balanço da experiência brasileira. *Revista de Administração da USP, São Paulo*, 30, 19-31. <https://www.rausp.usp.br/download.asp?file=3001019.pdf>
- Moreira, J. H. (2002). Modelo de gestão para incubação de empresas orientado a capital de risco. Dissertação (Mestrado) – Universidade Federal de Santa Catarina, Programa de Pós-Graduação em Engenharia de Produção. <https://repositorio.ufsc.br/bitstream/handle/123456789/82653/188461.pdf?sequence=1>
- NBIA. National Business Incubation Association (2015). Available at [http://www.nbia.org/resource\\_library/faq/#1](http://www.nbia.org/resource_library/faq/#1) Acess April, 7, 2015.
- Padua, E. M. M. (2005). Metodologia da Pesquisa – Abordagem teórico-prática. 4ª ed. Rev. atual. Florianópolis: UFSC.
- Potrich, A. C. G.; Vieira, K. M.; Nunes, R. C. (2013). Gestão da segurança da informação: caracterização da Incubadora tecnológica de Santa Maria. *Revista GEINTEC*, 3, 167-185. <http://dx.doi.org/10.7198/S2237-07222013000200014>
- Raupp, F. M. Beuren, I. M. (2011). Perfil do suporte oferecido pelas incubadoras brasileiras às empresas incubadas. *Revista Eletrônica de Administração*, 17, 330-359. <http://dx.doi.org/10.1590/S1413-23112011000200002>
- Ribeiro, S. A. Andrade, R. M. G. Zambalde, A. L. (2005). Incubadoras de empresas, inovação tecnológica e ação governamental: o caso de Santa Rita do Sapucaí (MG). *Cadernos EBAPE.BR, Edição Especial*. 1-14. <http://dx.doi.org/10.1590/S1679-39512005000500010>
- Robinson, D. F. (2010). The Co-evolution of Business Incubators and National Incubator Networks in Emerging Markets. *Journal of Technology Management & Innovation*, 5, 1-14. <http://dx.doi.org/10.4067/S0718-27242010000300001>

- Russi Junior, A. (1999) Metodologia para avaliação e seleção de projetos de empreendimentos de base tecnológica: com enfoque em incubadoras de empresas. Dissertação (Mestrado) - Universidade Federal de Santa Catarina, Centro Tecnológico. <http://repositorio.ufsc.br/xmlui/handle/123456789/81028>
- Shin, T. Lamy, E. (2006). Caminhos do conhecimento comercial: Formas e conseqüências da sinergia Universidade-empresa nas incubadoras tecnológicas. *Scientiae studia*, 4, 485-508. <http://dx.doi.org/10.1590/S1678-31662006000300008>
- Silva, M. A. O. M. Gomes, L. F. A. M. Correia, M. F. (2009). Cultura e Orientação Empreendedora: uma Pesquisa Comparativa entre Empreendedores em incubadoras no Brasil e em Portugal. *Revista de Administração Contemporânea (RAC)*. 13, 57-71. <http://dx.doi.org/10.1590/S1415-65552009000100005>
- Silva, J. M. Silva, C. E. S. Batista, G. D. M. Bitencourt, M. P. (2012). Impacto das funções desempenhadas pelos gerentes nos resultados da incubadora: survey realizada na rede mineira de inovação. *Produção*. 22. <http://dx.doi.org/10.1590/S0103-65132011005000067>
- Silveira, R. M. C. F.; Bazzo, W. R. (2009). Ciência, tecnologia e suas relações sociais: a percepção de geradores de tecnologia e suas implicações na educação tecnológica. *Ciência & Educação*, v. 15, n. 3, p. 681-694. <http://dx.doi.org/10.1590/S1516-73132009000300014>
- Silva, E. L; Menezes, E. M. (2005). Metodologia da Pesquisa e Elaboração da Dissertação. 4ª ed. Rev. atual. Florianópolis. UFSC.
- Sousa, M. A. B.; Beuren, I. M. (2012). Expectativas percebidas pelos empreendedores no processo de incubação. *Revista GESTÃO.Org*, 10, 01-27. <http://www.revista.ufpe.br/gestaoorg/index.php/gestao/article/view/271>
- Van Hemmen, S. Urbano, D. Alvarez, C. (2013). Charismatic leadership and entrepreneurial activity: an empirical analysis. *Innovar*, v. 23, 53-66. <http://www.redalyc.org/pdf/818/81828692005.pdf>
- Veloso Filho, F. A. Nogueira, J. M. (2006). Sistemas de inovação e promoção tecnológica regional e local no Brasil. *Interações*, 8, 107-117. <http://www.scielo.br/pdf/inter/v8n13/a12v8n13.pdf>
- Xavier, W. S.; Martins, G. S.; Lima, A. A. T. F. C. (2008). Fortalecendo empreendimentos em TI: qual a contribuição das incubadoras? *Revista de Gestão da Tecnologia e Sistemas de Informação*, 5, 433-452. <http://dx.doi.org/10.4301/S1807-17752008000300001>
- Zimmermann, D. M.; Cário, S. A. F.; Rauen, A. (2009) Caracterização econômica e dinâmica inovativa das empresas de software em incubadora de base tecnológica em Santa Catarina. *Análise*, 20, 48-66. <http://revistaseletronicas.pucrs.br/ojs/index.php/face/article/view/6202>
- Zouain, D. M.; Silveira, A. C. (2006). Aspectos estratégicos do modelo de gestão em incubadoras de empresas de base tecnológica. *Cadernos EBAPE.BR*, 4, 1-14. <http://dx.doi.org/10.1590/S1679-39512006000300009>
- Zouain, D. M.; Torres, L. S. (2005). A suposta modernização das relações de trabalho nas incubadoras de empreendimentos. *Cadernos EBAPE.BR, Edição Especial*, 1-14. <http://dx.doi.org/10.1590/S1679-39512005000500006>



# Research Results Transfer towards the Productive Sector via Research Collaboration in Four Colombian Public Universities

*María Eugenia Morales Rubiano*<sup>1\*</sup>, *Pedro Emilio Sanabria Rangell*<sup>1</sup>, *Paola Andrea Plata Pacheco*<sup>1</sup>,  
*Fabian Arley Ninco Hernández*<sup>1</sup>

**Abstract:** This article shows the determining factors in the research results transfer towards the productive sector via research collaboration in four Colombian public universities. Thirty heads of units in the aforementioned universities were interviewed, which served to determine eleven cases of study and conduct interviews with thirty-five participants ranging from researchers, participant in formation and business people, in each case, it was found that especially in the last decade universities have turned to creating capacities for research collaboration as well as an openness in participants to create links that not only go in favor of enriching the productive sector but also in strengthening formation and research processes. It was concluded that there is a recent growing interest in the different actors in strengthening the bonds between the universities and the productive sector, though there may be some difficulties in the process of research collaboration due to the lack of an appropriate regulatory framework.

**Keywords:** University-Industry relations; R&D transfer; research collaboration; public universities; case-studies; Colombia.

Submitted: August 25th 2015 / Approved: December 1st 2015

## Introduction

The university, as a producer and transmitter of knowledge, has generated strategies to bond itself to its surroundings and strengthen social and productive organizational capacities. Historically, universities have undergone the aforementioned process through teaching and research, but in these functions, the production of knowledge most of the time happened in isolation from the real social context. With the rise of the “third mission”, universities have started to make active links with organizations through diverse transfer dynamics so that the generated knowledge gets social applications (Lee, 1996; Davies *et al.*, 2008; D’Este & Patel, 2007).

Among the strategies to transfer knowledge to the surroundings there is the university-productive sector relationship (U-PS/R) which seeks to contribute to the economic development of organizations as well industrial competitiveness (Geiger & Creso, 2005; Markman *et al.*, 2005). This relationship is also the result of the permanent need of organizations to belong to an economic system that revolves around innovation and competitiveness. This way, the close relationship between science and technology is taken advantage of, as well as the diverse sources of innovation and the creation of internal knowledge networks to set up mechanisms, channels or relationships between different actors towards knowing and promoting organizational innovation processes (D’Este & Patel, 2007; Meyer-Krahmer & Schmoch, 1998; Perkmann & Walsh, 2007).

The university, as an actor in systems of innovation and in compliance with the requirements of society has generated an internal structure devoted to research, development and innovation processes (R+D+I) including groups, institutes and research centers that allow to set up

communication channels for transferring research results to the surrounding environment.

Among the various bonding dynamics that make up for the use of research results in organizations, there is Research Collaboration (RC) which implies several research organizations, technological development and/or the productive sector in (R&D+I) activities with high exploitation potential; each participant commits to the collective in giving resources and/or research efforts towards project development while seeking to increase competitive advantages and serve as an economic growth engine (OECD, 2004; D’Este & Patel, 2007; Ponomarev & Boardman, 2008).

Y. S. Lee (1996) points that RC activities are one of the most effective means to accelerate result flow to the surroundings, especially in the productive sector. Meyer-Krahmer and Schmoch (1998), in a Germany-based study, confirm that the two-way relationships (such as RC activities) are seen by academic researchers as “more interesting” since its level of complexity require a cooperation between the university and the industry and an information exchange between the actors that make them more relevant than those who are lineal or unidirectional. In spite of this, there are many more studies on other transfer channels (such as the commercialization of industrial property or academic entrepreneurship) than in U-PS/R that stem from RC, this due to the difficulty of accessing parametrized information (Perkmann & Walsh, 2007; Meyer-Krahmer and Schmoch, 1998).

In the Latin-American scenario, success cases like Mexico, Brazil and Chile have set the foundation to form a commitment between the different actors in the innovation system that ease U-PS/R and imply a significant change in the traditional conditions of the Latin-American

<sup>1</sup> Grupo de Estudios Contemporáneos en Contabilidad Gestión y Organizaciones, Faculty of Economic Sciences, Universidad Militar Nueva Granada, Bogotá, Colombia.

\*Corresponding author: maria.morales@unimilitar.edu.co



University oriented exclusively to solving social problems (Cabrero *et al.*, 2011; Saavedra, 2009)

Even though Colombia has seen a significant increase in the U-PS/R, it has not generated definitions on internal research capabilities, formation and extension in academia that allows generating strategies that strengthen and encourage specialization in certain areas of innovation (Pineda *et al.*, 2011). Though some universities have implemented structures that make the relationship with their surroundings easier, there still are not surveys on U-PS/R and almost no studies on the determining factors for knowledge transfer from them to the outside. The aim is to pinpoint those factors that make research result transfer via research collaboration (RTRC) to the productive sector possible in some outstanding cases in four public universities in Colombia, so that the actors of these systems take action in improving U-PS/R in the country.

This document initially describes RC as one of the most effective strategies in research result transfer (RRT) as well as the factors identified on it as part of a bibliographic review. It goes on to present the research method based on four university cases under the factors found in the aforementioned review, then the results are presented in a way that shows the determining factors for RC in each university and finally, the deciding factors for RC in the practices of the Colombian universities that were subjected to this study.

Table 1 shows a synthesis of goals, methodology and results made in international settings that sought to identify the channels and factors that are present in the University/Industry relationship (U/I R) based on national surveys, collaborative comes out as the most efficient result transference mechanism.

Table 1. International referents on U/I Linking

Author	Objective	Methodology	Results
Y. S. Lee (1996)	Finding technology transfer U/I interaction mechanisms in the United States	Information obtained through a survey of 1000 members of American universities intensively engaged in research is discussed.	When comparing 1990 results with results from the previous decade, researchers have a greater disposition to work side-by-side with the industry
D'Este and Patel (2007)	Identify channels that rely on the variety of U/I interactions in The United Kingdom	Identify U/I transference channels from surveys to academic researchers in the United Kingdom	U/I interactions are present in several communication channels, being more common those in consulting, research contracts, collaborative research and training
Perkmann and Walsh (2007)	Establish a research base to promote U/I interactions oriented to innovation	A new framework is proposed to distinguish U/I relationships from diverse mechanisms such as technology transfer and mobility through bibliographic review. Mechanisms that stem from practices are analyzed.	Research concludes that U/I interactions are a common practice and different transference channels depend on the industries and scientific disciplines.
Meyer-Krahmer and Schmoch (1998)	Gather empirical evidence from U/I Interactions on 4 technological areas based on basic and applied sciences in Germany	From discussions around a survey in German Universities, bibliographic review and primary information gathering, evidence of U/I interactions was sought	It was found that the robust innovation system in Germany was a result of the strong interaction between science-based areas and the impact they have had in the industry. This impact generates U/I cooperative relationships for continuity, development and economic development.

## General Framework

### Collaborative Research as a university-productive sector bidirectional binding strategy

When adopting the third mission, one of the more pressing commitments that the university had acquired has been the transferring academic research results to the productive sector as means to support economic growth. The existence of communities (producers and users of knowledge) urges to generate different types of interaction between them (linear – push/pull – bidirectional) (Davies *et al.*, 2008; Perkmann & Walsh, 2007).

Linear interactions cause some problems: the push model needs to be achieved by attracting a business towards the offer of knowledge in the university and the pull model tries to avoid skewing the advances of science since research is hired by the productive sector with a particular interest (Lee, 1996; Meyer-Krahmer & Schmoch, 1998; Perkmann & Walsh, 2007; D'Este & Patel, 2007; Davies *et al.*, 2008). Research Collaboration can be found under bidirectional interactions, it implies joint work among several organizations in developing R&D+I projects with a high exploitation potential in the productive sector; participation can happen through resources and/or research efforts (OECD, 2004; D'Este & Patel, 2007; Ponomarev & Boardman, 2008). This model's advantage is the start of a relationship which can begin via informal means, with the creation of knowledge networks originated in conferences and research publishing to later become more formal in a long-term relationship (Meyer-Krahmer & Schmoch, 1998).

### Research results transfer via research collaboration driving factors

Through documentation and existing studies on RC six categories for analysis and study of R&D+I are presented: R&D transfer approach, linking units and transfer mechanisms, characteristics of the actors

(researcher, university, unit personnel, participant in formation and benefiting organization), R&D process, internal capabilities of the university and surroundings conditions (organization, State and society); that gather the different driving factors for executing RC processes and that represent the reference framework for this research (table 2).

Table 2. Result Transfer Factors on Collaborative Research Transference

Category	Subcategory
<b>R&amp;D Focus</b>	Social and economic development transfer focus
	Social and cultural development transfer focus
<b>Liaison or linking unit, mechanisms</b>	Link or transfer unit type
	Linking Mechanisms
<b>Actor's Characteristics</b>	Innovator Profile
	Innovator's position and capabilities on technology transfer
	Linking unit Personnel's profile
	University's profile
	Participating organization's profile
	Beneficiary's position and capabilities
	Student profile
	Student's position and capabilities
<b>R&amp;D Process</b>	R&D Motivation
	R&D Formulation/Planning
	Actor's participation in R&D Processes
	R&D Development and Execution
	Transfer Status
	R&D appropriation and Transfer
<b>Internal Capabilities (University)</b>	Policies oriented to collaborative research and knowledge transfer
	Resources oriented to collaborative research and knowledge transfer
	University's perspective on collaborative research and knowledge transfer
<b>Surroundings Conditions</b>	Organization's conditions
	State Conditions
	Society Conditions

### Method

An exploratory and qualitative research was conducted, taking the multiple-case study as the method. Four (4) cases in Colombian public universities were taken into account: Universidad del Valle in Cali, Universidad Nacional de Colombia in Bogotá and Medellín, Universidad Militar Nueva Granada in Bogotá and Universidad de Antioquia in Medellín which for the purposes of this study were labeled

with letters (A, B, C, D, respectively). University B is located in several places of the country which makes up for a better and richer comparison of practices, having said this, two of the units for this university were labeled as B1 and B2 respectively.

For each university cases, where RC took place, were taken into account, specifically in the engineering and basic - applied sciences areas for being frequent places of interaction for this type of research

mode. The last five years (2009-2013) were taken as time frame and the selection of these cases was made by interviewing 30 heads of linking units (heads of transfer, research or extension units, research group directors or research center/institute directors, see table 3) whose knowledge and experience brought a general perspective on the characterizing factors for RTRC in their respective universities.

The study was performed in 11 cases which meant that a contact with those who participated was made in order to gather their experiences.

For each case an interview was set for the head of research, who was the person in charge of leading the project from the academic perspective; another interview for a participant in formation linked to the project who served for gathering the research student or young researcher or research assistant point of view, and one for the industry/organization representative which participated or was benefited from the knowledge and development generated. This made up for a total of 35 participants (table 3).

Table 3. Transfer process actors interviewed per university

University - City	Profile	Number of interviews
University A: Cali	Head of linking unit	7
	Main researcher	3
	Participant in formation	3
	Business Representative	3
	<b>Total interviewed</b>	<b>16</b>
	<b>Studied cases</b>	<b>3</b>
University B1: Medellín	Head of linking unit	7
	Main researcher	3
	Participant in formation	2
	Business Representative	2
	<b>Total interviewed</b>	<b>14</b>
	<b>Studied cases</b>	<b>2</b>
University B2: Bogotá	Head of linking unit	6
	Main researcher	2
	Participant in formation	2
	Business Representative	2
	<b>Total interviewed</b>	<b>12</b>
	<b>Studied cases</b>	<b>2</b>
University C: Bogotá	Head of linking unit	4
	Main researcher	2
	Participant in formation	2
	Business Representative	3
	<b>Total interviewed</b>	<b>11</b>
	<b>Studied cases</b>	<b>2</b>
University D: Medellín	Head of linking unit	6
	Main researcher	2
	Participant in formation	2
	Business Representative	2
	<b>Total interviewed</b>	<b>12</b>
	<b>Studied cases</b>	<b>2</b>

The interviews were structured according to the categories and factors reference frame (table 3) which was made up from a bibliographic review on the subject. The instrument meant to gather data by formulating semi-structured open questions on the incidence of certain

aspects for RTRC, according to the literature (studies and national as well as international experiences) in elaborating an instrument that considered each participant was aware of the processes and points of view and for that matter, interview scripts were constructed for each type of participant.

For the analysis of the information gathered, the discourse analysis technique was employed, powered by the NVivo 9 software. The interviews were then, transcribed and categorized in order to obtain a reference count that made the identification of repeating factors in the interview possible. Selection of the determining factors was

made by taking the higher reference count for category in at least three of the universities since this implies that all parts acknowledge these conditions as relevant when it comes to the process of collaborative research between the university and the productive sector.

## Results

### Scope and transfer profile

When mentioning the scope, interviewees point out that the scope of a research-oriented to research and development (R&D) jointly with the productive sector (Acevedo *et al.*, 2005; Heidrick *et al.*, 2005) however, they also mention scientific and technical training of personnel as an important factor (Geiger & Creso, 2005) (fig. 1).

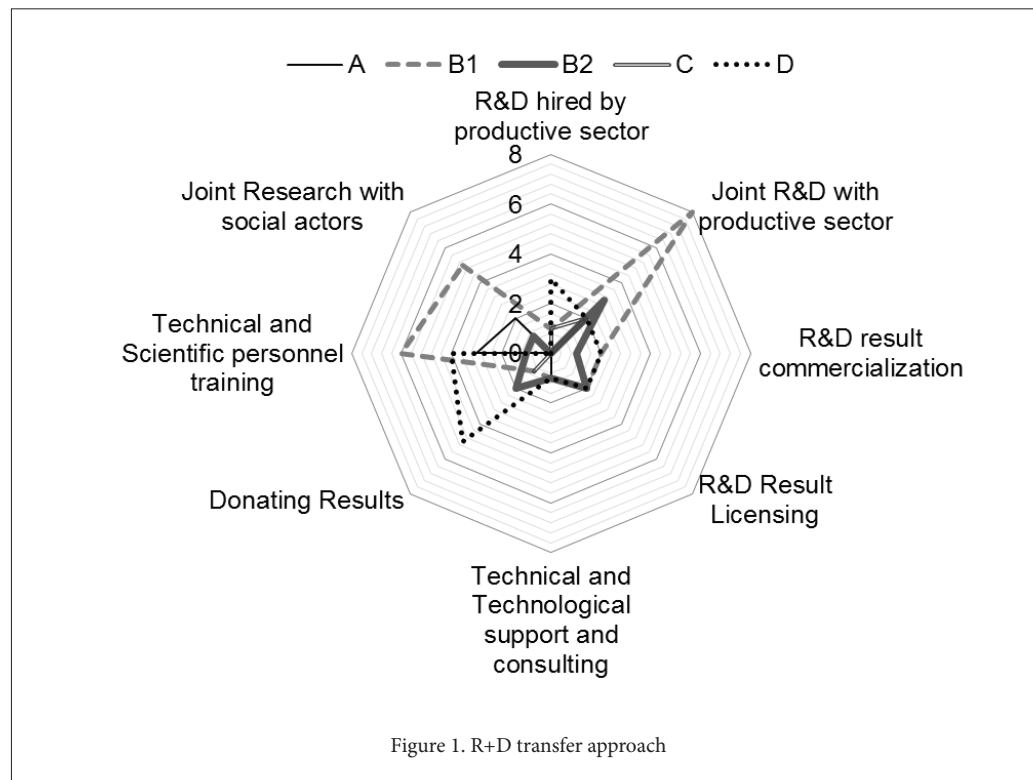


Figure 1. R+D transfer approach

Interviewees from universities A and B1 make reference on joint research with social actors (Baird, 2003) while university D sees in donating R&D results (Arias & Aristizabal, 2011) as a mean for achieving developments. Universities B1, B2, and D take for licensing R&D results; however, this and other factors related to an economic approach (Acevedo *et al.*, 2005) as well as R&D contracted by the productive sector, commercialization of R&D results and technical and technological consultancy and support (Garcia, 2008) do not show up in this category.

In reference to the university profile, University D shows itself as a social and entrepreneurial institution (Fernández *et al.*, 2000) which shows that the university is making efforts from within and from several different focuses to build better bridges with its surroundings,

since both these profiles bring a strong connotation in the university's role as an active member in society.

On the other hand, universities, A, B1, B2, and C see themselves as traditional institutions (Dexter *et al.*, 2007; Fernández *et al.*, 2000), this means that they center their activities in teaching and research. Finally, from this first category family we can come to the conclusion that in spite of the bias there might be towards an economic focus due to the deliberate selection of cases where there has been collaboration with the productive sector, it is relevant for public universities to transfer their results to its surroundings for economic gain, but without leaving behind its mission of scientifically and technically forming those who take part in said processes.



## Linking units and mechanisms

The interviewees show that universities where there are different linking units, but the three that were referenced the most were research groups, national-level units (COLCIENCIAS, INNPULSA, and Ministries) and internal units that support transference processes (table 4).

Table 4. Linking units by University

University	Linking Units
<b>A</b>	Research Groups
	National Level Units (Colciencias, Innpulsa, Ministries and others)
	Development and Technology Transfer Office or IP
<b>B1</b>	Research Groups
	Regional development agencies (Connect, Tecnova, Others)
	Development and Technology Transfer Office or IP
<b>B2</b>	University Labs
	Vice Dean Offices
	Extension Division
	National Level Units (Colciencias, Innpulsa, Ministries and others)
<b>C</b>	Research Groups
	Vice Dean Offices
	Extension Division
	National Level Units (Colciencias, Innpulsa, Ministries and others)
<b>D</b>	Research Groups
	Regional development agencies (Connect, Tecnova, Others)
	Development and Technology Transfer Office or IP

\*Colciencias is the national administrative department in science, technology and innovation of Colombia,

\*\*Innpulsa is a government institution established in February 2012 to support and promote extraordinary entrepreneurial growth.

\*\*\*Ministries make especial reference to Rural Development and Agriculture, Commerce, Industry and Tourism Ministries of the Colombian Government.

† Connect and Tecnova are technology transfer offices of the regional government in the cities of Bogotá and Medellín, respectively

According to the profile of the personal that works in the linking or transfer units, for the universities, the main input comes from those who do RCTR (Table 5). In general, it comes to attention the work

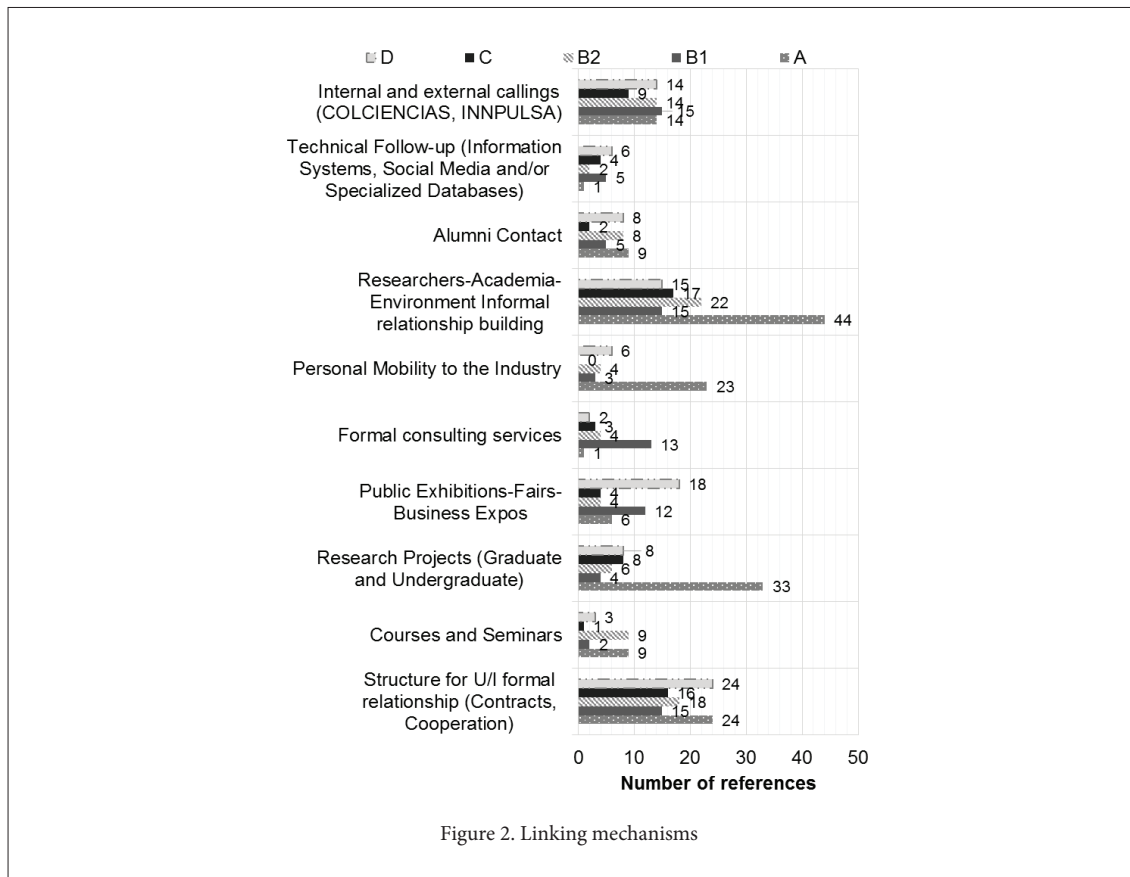
they do to integrate a research group with an industry one (Siegel *et al.*, 2004; Bjerregaard, 2009) and the knowledge the links bring into bargaining processes (Gertner *et al.*, 2011; Markman *et al.*, 2005).

Table 5. Linking unit personnel profile per university

University	Linking unit personnel profile
<b>A</b>	Scientific knowledge
	Seeks to integrate a research group with an industry one
	Knowledge about intellectual property (IP)
<b>B1</b>	Legal Knowledge
	Seek to integrate a research group with an industry one
	Negotiation Background
<b>B2</b>	Seek to integrate a research group with an industry one
	Knowledge on bargaining
	Technology Assessment Knowledge
<b>C</b>	Seek to integrate a research group with an industry one
<b>D</b>	Knowledge on bargaining
	Knowledge about IP

From the previous statements, it can be inferred that the different internal and external units which universities have to interact with their surroundings are working to be a complement in research when it comes to dealing with the productive sector, and are a key factor in matters like compatibility, business culture and bargaining processes in results.

When speaking of linking mechanisms, the interviewees emphasize that a relationship with the productive sector starts in an informal setting (Arvanitis *et al.*, 2011; Ponomariov & Boardman, 2008; Siegel *et al.*, 2004) to later formalize agreements, contracts and cooperation (Arvanitis *et al.*, 2011; Siegel *et al.*, 2004; Ramos-Vielba & Fernández-Esquinas, 2012) for university B, internal and external callings (Vestergaard, 2005) serve as linking mechanism (fig. 2).



In particular terms, for University A, the most important linking mechanism is dissertation projects from students and for university D, public exhibitions such as fairs, business conferences (Siegel *et al.*, 2004) stand at the top of their list.

From these results, it can be observed that for implementing RTRC processes, universities not only need support from their linking or transfer units (internal or external) but it is vital for them to develop mechanisms in which strategies come from informal settings (centered around the researcher) to later get to formal actions that are handled at an institutional level.

### Participant Characteristics

In table 6, results for profile, position and researcher's motivation are gathered for each of the universities that participated in the study. A growing relationship between the researcher and the productive sector is evidenced in this table (Colyvas, 2007; Krucken *et al.*, 2007; Siegel *et al.*, 2004; Bozeman, 2000; Vestergaard, 2007) this is also shown in the results on mechanisms that indicate that a link stems from informal settings as well as in a profile-oriented to contribute with the productive sector (Lakpetch & Lorsuwanarat, 2012), seeking to apply knowledge in a real context (Lee, 2000; Azagra, 2003) without leaving the scientific formation of students behind (Geiger & Creso, 2005; Vestergaard, 2007).

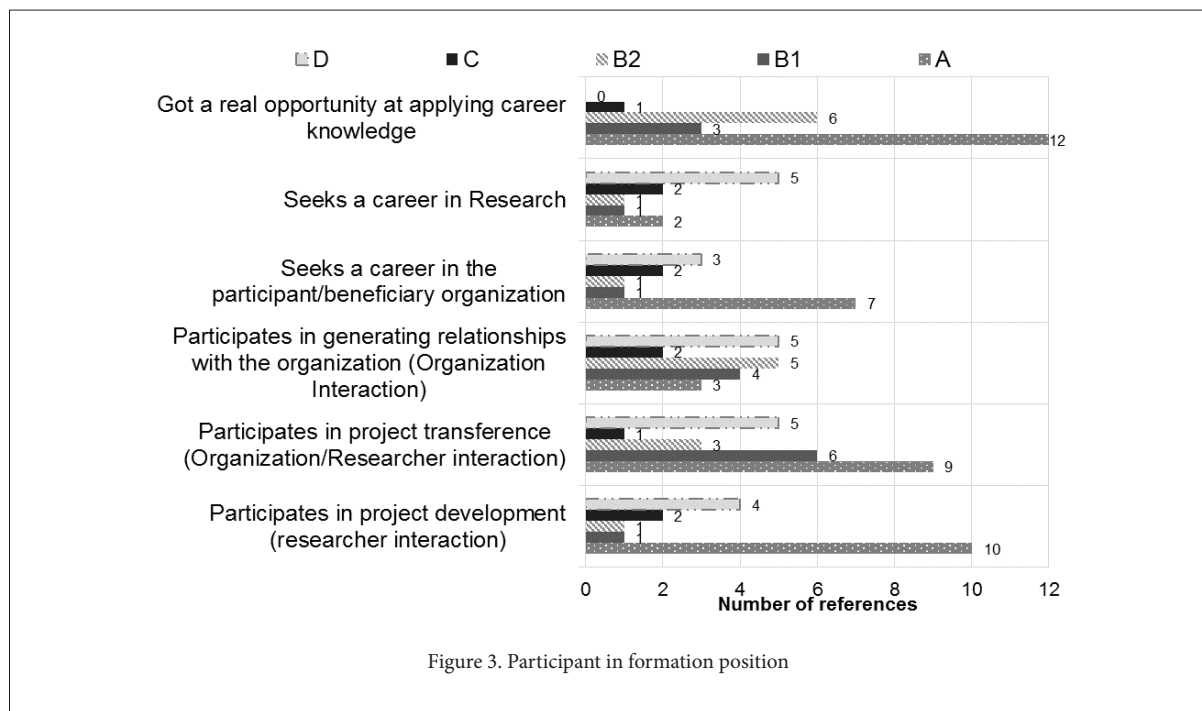
Table 6. Profile, position and researcher's motivation

	A	B1	B2	C	D
Researcher profile	Researcher commitment to the needs of the productive partner				
	Researcher business experience		Researcher recognition by industry	Researcher level of education	Researcher recognition by industry
	Research experience				Researcher attitude and social skills
Researcher position	The researcher is willing to take part in research agreements, partnerships, extension				
	The researcher preferred to conduct the transfer through teaching (Support for dissertations)				
	The researcher prefers to transfer through relationships with students in the production sector		The researcher prefers the scientific recognition over the private sector recognition.		
R&D motivation	The pursuit of knowledge application in a real context				
	The selection of useful issues for the social context	The tailored development of research products through business cases	The selection of useful issues for the social context	The Gap in the market for innovation	The selection of useful issues for the social context
	The Gap in the market for innovation				

When referring to the participant in formation position (young researcher, research assistant or student researcher), three universities (B, C and D) met the role of generating relationships with the benefiting institution (Silvernagel *et al.*, 2009) which means that during their relationship with the project the interaction was made mainly with the industry. Another aspect of this is their motivation take on

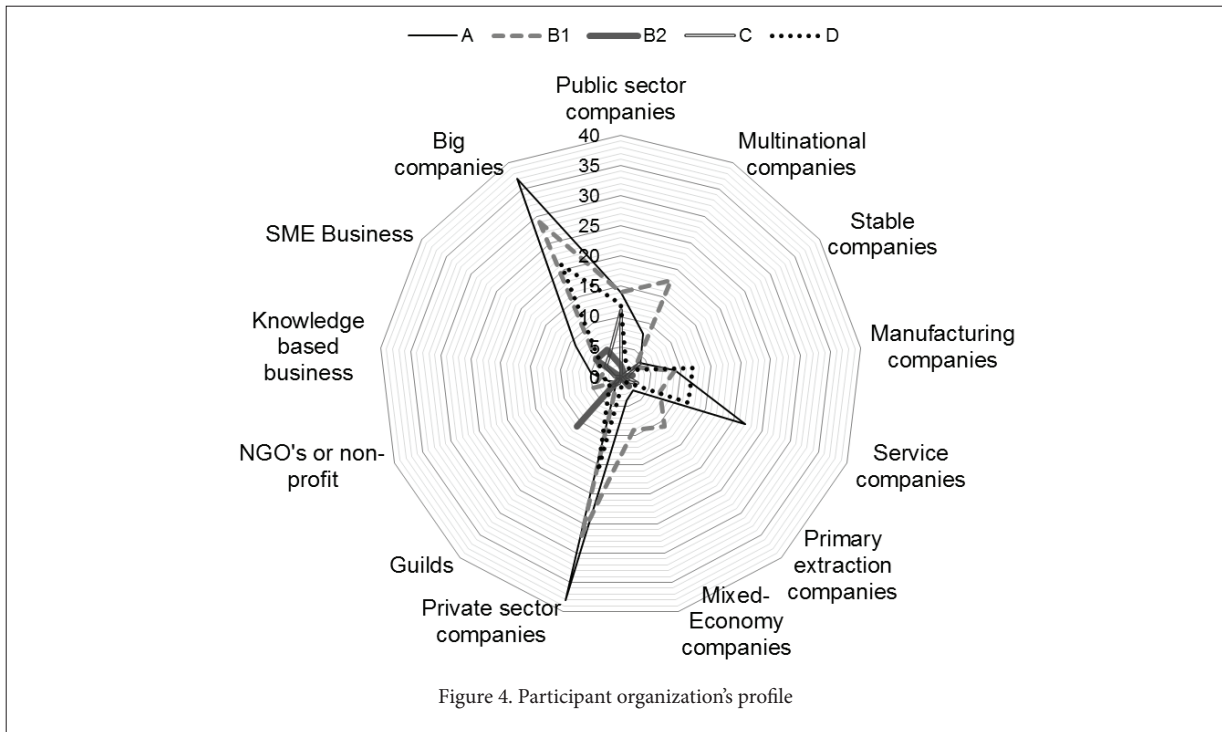
the project (fig. 3). University A showed as a means to make a career in the organization (Thune, 2009) whereas in university D, RC is just a means to start up a career in research (Thune, 2009).

For most of the interviewees, having taken part in the projects gave them the opportunity to apply what they had learned in a real setting.



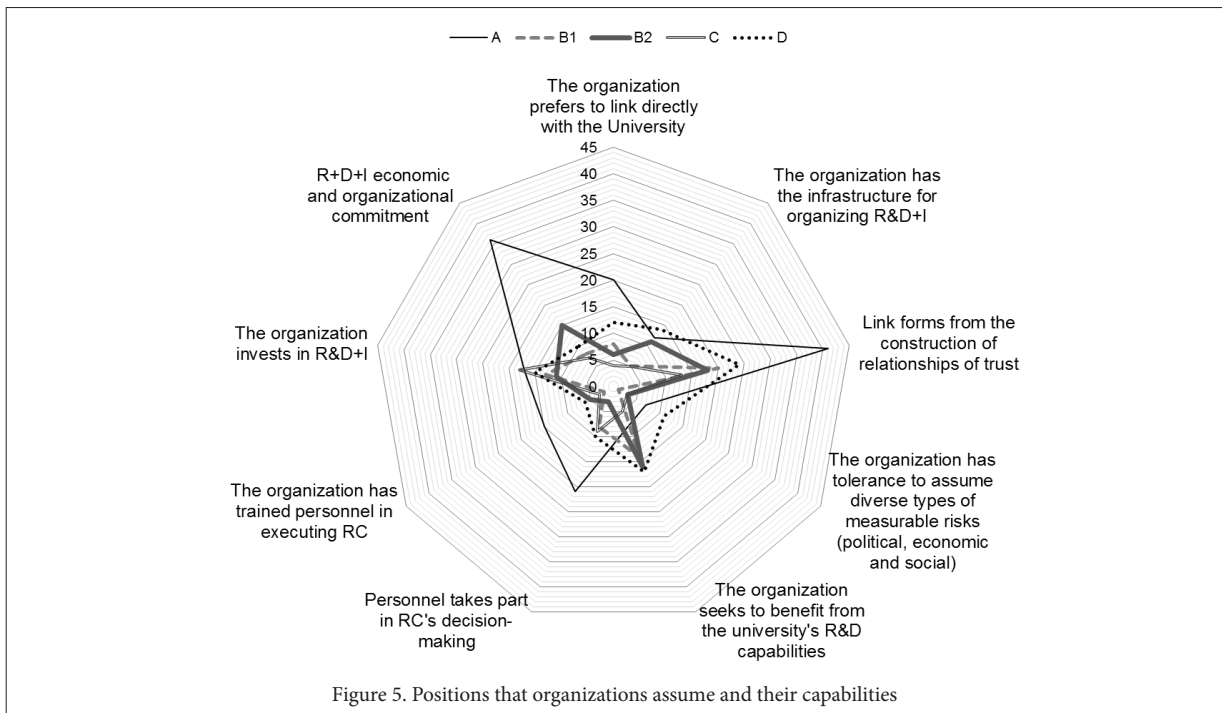
When referring to participant organization's profile in RTRC it is observed that universities A, B1, and D relate in greater measure to private sector organizations (Hanel & St-Pierre, 2006), and they are

also catalogued as large industries (Hanel & St. Pierre, 2006; Meyer-Krahmer & Schmoch 1998) while university B2, works mostly with guilds and university C works with the public sector (fig. 4).



In regard to positions that organizations assume and their capabilities when it comes to RTRC, it is evidenced that most of them have processes that invest in R&D activities (Y. Lee, 2000) which allows them to commit to the economic and organizational support of R&D+I

(Heidrick *et al.*, 2005) when organizations are linked to RC processes as it has been evidenced, the link is made through trust relationships with the researcher (Gertner *et al.*, 2011; Krucken *et al.*, 2007; Lakpetch & Lorsuwannarat, 2012) (Fig. 5).



Up until this point, four main actors or main participants in a RC process have been studied and a researcher's profile that is more industry oriented has been identified, this profile seeks to complement teaching and research from the relationship there is with the private sector; participants in formation that link themselves to projects related to their dissertations so that they can apply their knowledge in real settings and get a better contact with the industry while doing so (or start either a career in the industry or in research) and as a majority, they link to private organizations that have the resource and the openness to work with academia and take advantage of the knowledge this latter one generates.

## R+D Transfer and development process

Another aspect to take into account is the process in which RTRC takes place, one key factor is a project planning, this phase establishes initial conditions for execution (fig. 6). Every University has a planning process (Acevedo *et al.*, 2005; Burnside & Witkin, 2008; Jaramillo, 2005; Morandi, 2013) where several meetings happen to ensure a proper follow-up on project advancements, another important aspect to consider is establishing previous agreements on industrial property (Morandi, 2013; Silvernagel *et al.*, 2009) that may come up at the beginning of the project itself.

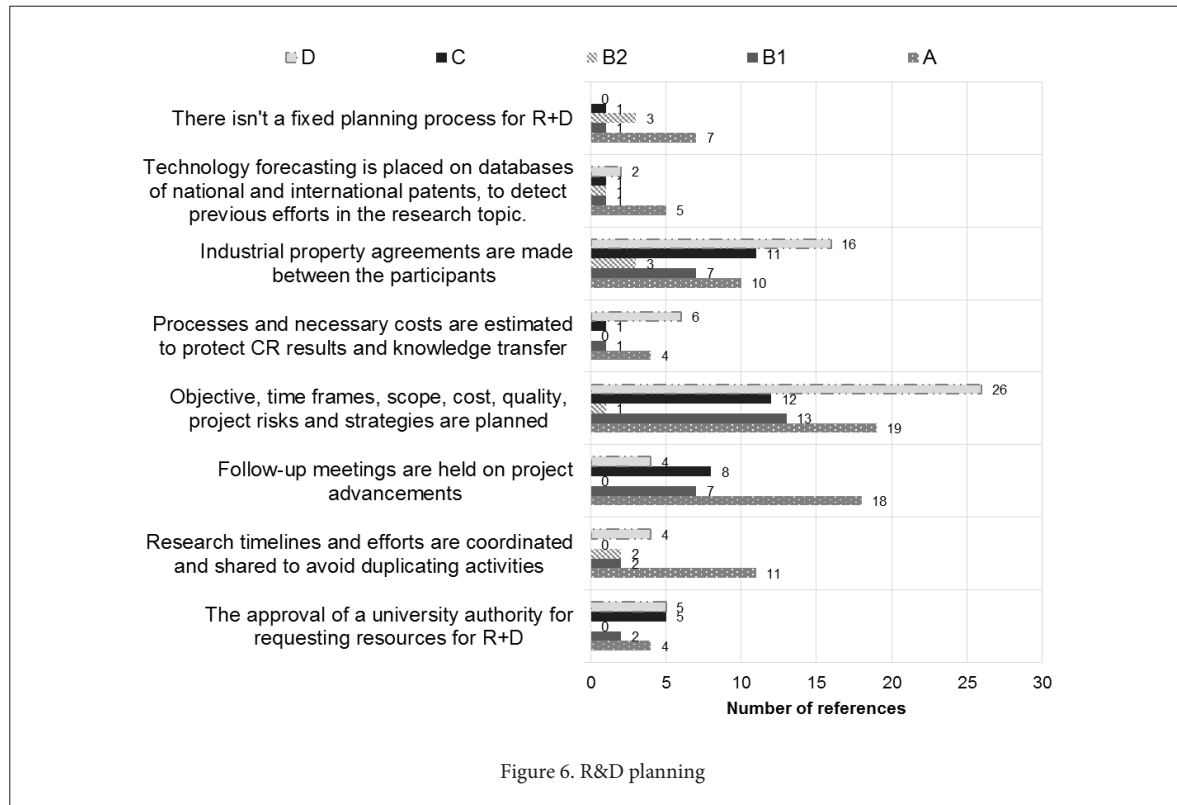
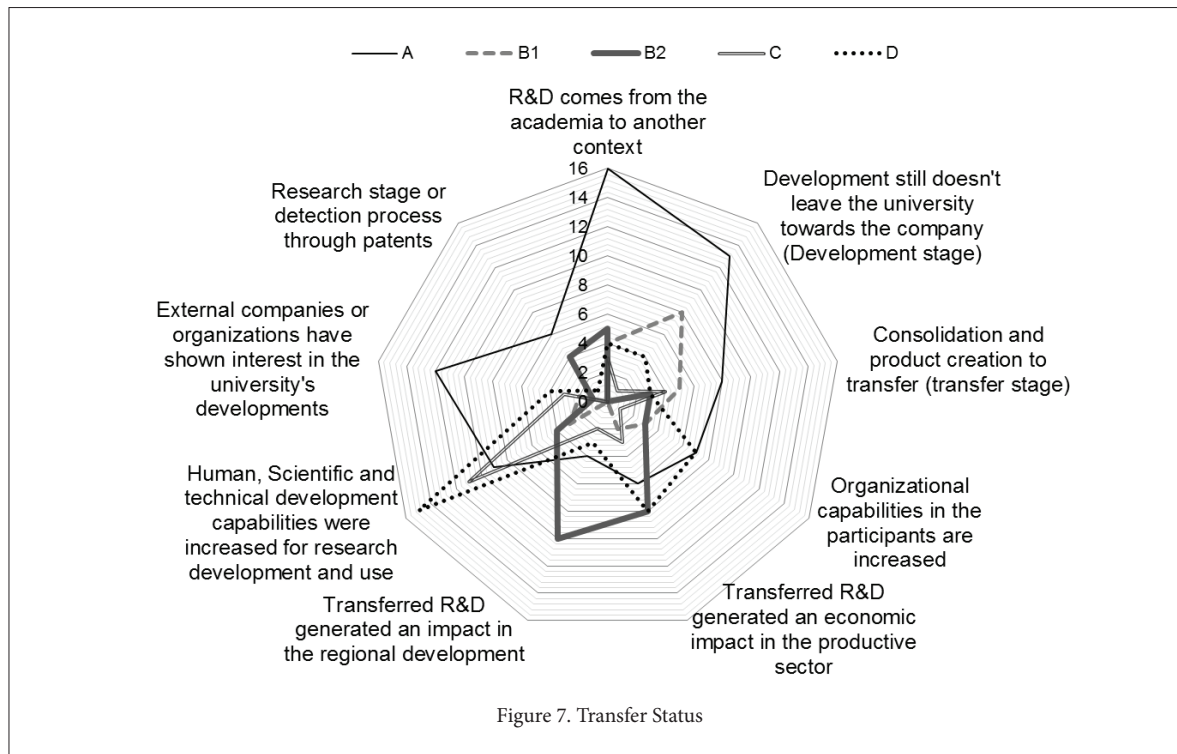


Figure 6. R&D planning

Multiple actor participation is also a very important aspect to take into account in a joint development effort (Burnside & Witkin, 2008; Krucken *et al.*, 2007) for all the universities that took part on the study, there are cases where one of the parts takes on development, which means that either the university or the organization would lead and develop the project at hand, this is mostly true for universities A, B1 and C, academic development with industry instructions (Krucken *et al.*, 2007). Participative research is also evidenced in universities A, B2 and C. Projects in which the development is the hands of several organizations is not evidenced in spite of university B2 having experiences in which not only academia and productive sector work together, but other scientific organizations have taken part in the development of a project as well as the resultant transfer for the research.

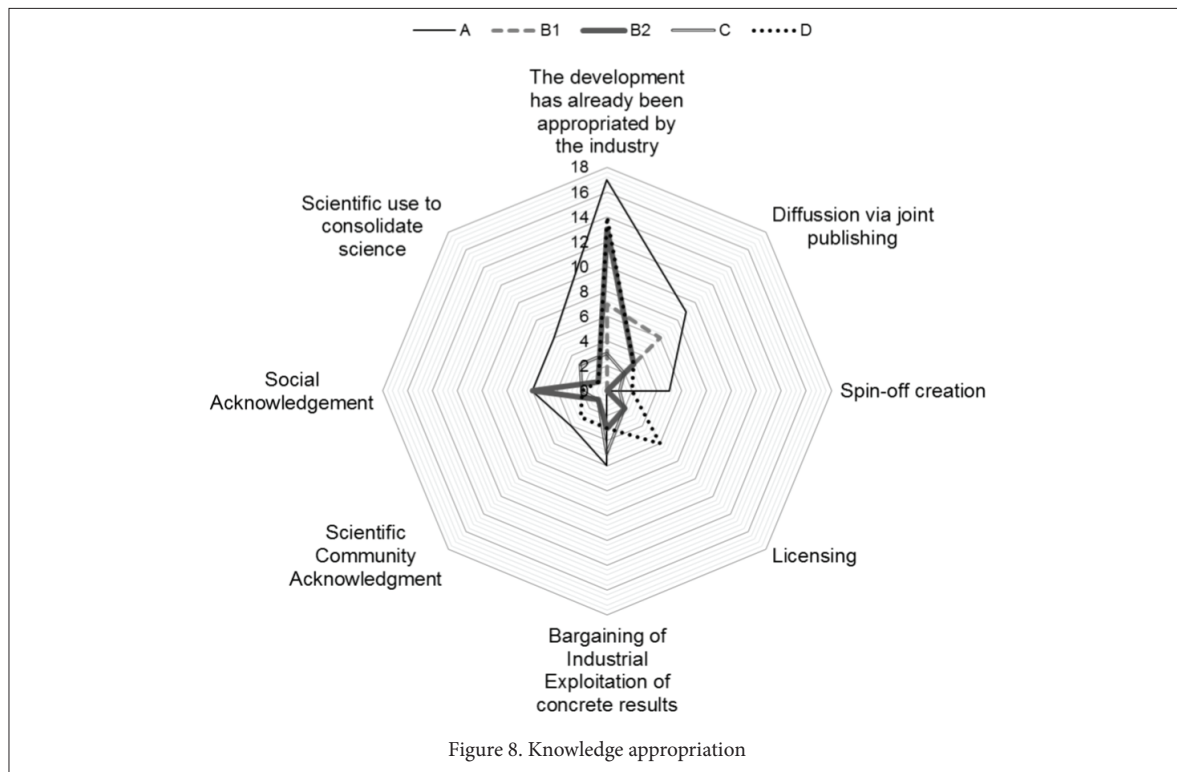
In the state of appropriation and transfer, university A shows that their projects are still in the development process or have been taking away to different contexts and external organizations have shown interest in the development process. Projects in university B1 are in a stage of consolidation and product generation that can be transferred; this means that the research still has not left the university. University B2 indicates that projects are generating impact on a regional level (Bozeman, 2000). Universities C and D give greater importance to the transfer as a way to increase participant personnel capabilities (Bozeman, 2000; Siegel *et al.*, 2004) (fig. 7).





When it comes to knowledge appropriation, three universities (A, B2 and D) show that the development has already been appropriated by the industry, which means that the latter one is at this point in a position to replicate the research. Universities A and B1 define appropriation in diffusion via joint publications. University B2 takes into

account the social acknowledgment (Acevedo *et al.*, 2005) that their developments have had in their endeavors. University C points out that they are at this point in bargaining processes with the industry (Payumo *et al.*, 2012) while University D has already licensed their findings (Siegel *et al.*, 2004) (fig. 8).



### Universities Internal Capabilities

When it comes to policies that favor RTRC, three factors have been found to be of importance, first there are the actions that the university takes to motivate their academic body, then there is establishing an active relationship with their surroundings through diverse channels (Dooley & Kirk, 2007; Fernández *et al.*, 2000) and finally, counting with a direction that adapts to the changes in the environment. These three factors are traits of entrepreneurial universities (Fernández *et al.*, 2009) and make explicit appreciations in universities A, B1, C and D. However, the entrepreneurial institution capability (Krucken *et al.*, 2007; Fernández *et al.*, 2000) was not referenced significantly from those who are beneficiaries.

University perspectives on RTRC (fig. 9) are different depending on the university even though all of them are driven to strengthen knowledge processes and knowledge transfer. Universities A, B1, and D consider that research should increase economic funds in the university and for their students. Research is costly and the government budget for R&D is not enough or convenient for project initiatives in research groups (due to slow processing times or required confidentiality by the organization) this situation drives the search for alternative funding means for the research to the point that, university D has pointed out that they have managed to handle the process with enough resources as to favor the teaching mission (through Ph.D. Scholarships for their students) through university funds. B2 University seeks to improve transference processes under the industrial property model while University C is driven by the need to transfer knowledge to its surroundings.

In resources and capabilities for RC (in number of references for those interviewed) difficulties in administrative processes are seen as a limiting factor in RTRC since they put a strain on research processes (when it's time to assign physical, economic and personnel resources) as well as times of project execution (severely affected by academic calendars). Quoting one of our interviewees, "The university deals in semesters, while the industry deals in seconds" this is clear evidence that times in academia and the industry are still a limiting factor for collaboration and creation of trust and commitment bonds between these two. The existence of economic and personnel resources is also pointed out for RC (Jaramillo, 2005; Siegel *et al.*, 2004) especially in universities B and D. Universities A, B1, C and D establish as a thriving resource the proper infrastructure so that the R+D comes to fruition (Jaramillo, 2005; Siegel *et al.*, 2004)

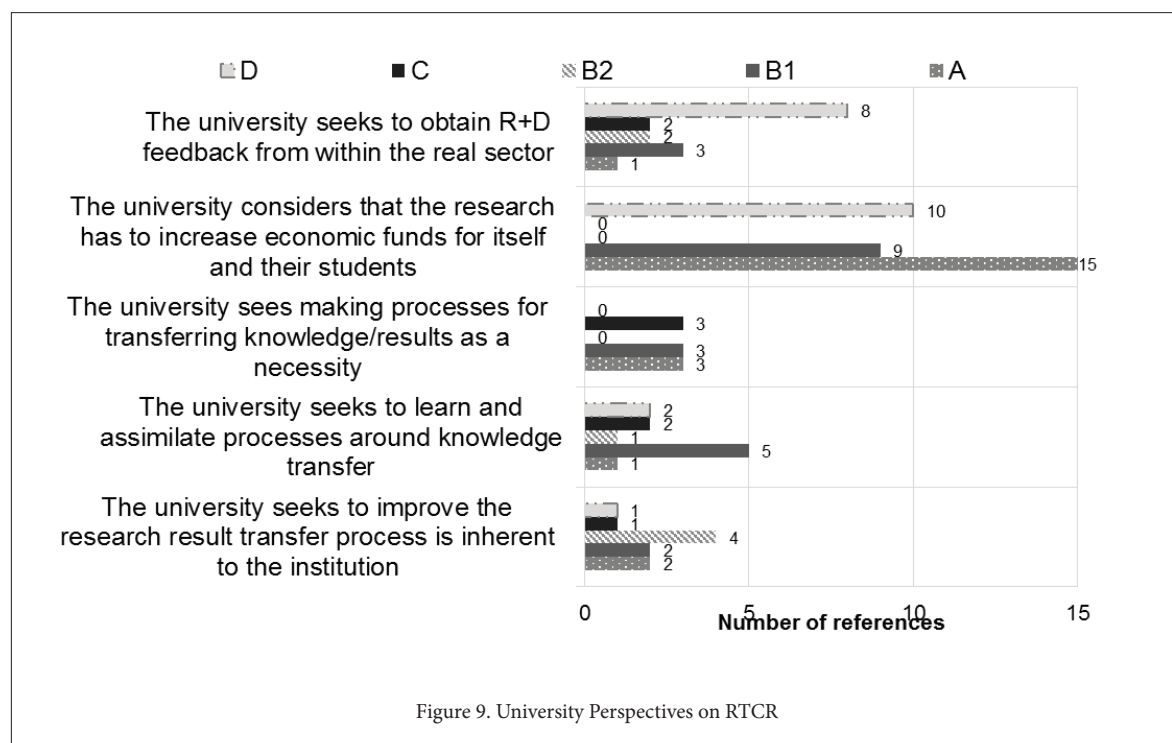


Figure 9. University Perspectives on RTRC

In conclusion, Universities A and D have a greater capability for RTRC processes as well as to generate an active relationship with the productive sector since their policies are oriented to create mechanisms that belong to the entrepreneurial university model and the

resources they have had allowed for collaborative processes. Universities B and C want to strengthen their capabilities, but they have several limitations in their processes and internal organization in the university.

### Surrounding conditions (organizations, society and State)

When speaking of the conditions generated by organizations and the productive sector to favor the RC, they are overall positive since organizations have a better relationship with academia and they see a

favorable link with it to the point that they see this relationship as a means to support economic ends (Heidrick *et al.*, 2005; Hanel & St. Pierre, 2006; Vestergaard, 2007) and this generates initiatives to know about the R&D+I activities in the university (Arvanitis *et al.*, 2011) (fig. 10).

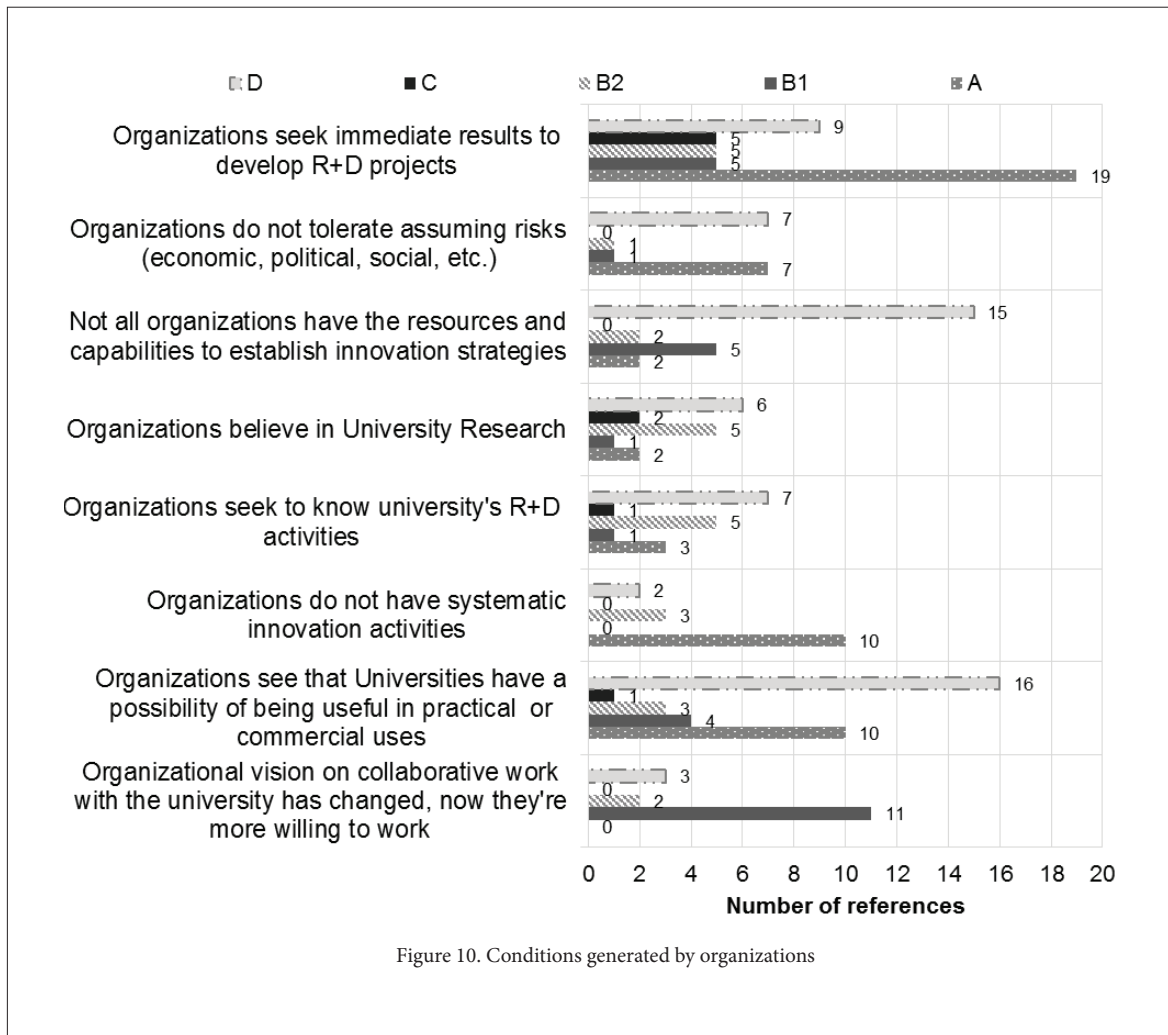


Figure 10. Conditions generated by organizations

Among the negative aspects that affect said conditions are the capabilities of the productive sector to generate and appropriate R+D+I since it is the big, private companies that have the possibility to create links with academia and the work that can be made with SME's is limited due to the resources and internal capabilities to manage R+D (Garcia, 2008; Kawasaki, 2009; Lai, 2011). Organizations still see the usage of different time frames as a limitation (Vestergaard, 2005) since their workflow is affected by the slow and interrupted time settings that universities work with.

On State-generated conditions, interviewees from universities A and D point out that in spite of having the resources for R+D (Azagra, 2003; Geiger & Creso, 2005; Vestergaard, 2007) the State has not made the connection between the university and the industry easy and also the regulations for public universities has not been clear in the creation of spin-offs for academics or the use of royalties for research among others. Universities B1 and D have also pointed out that the resources for science, research and technology have been "politicized" (fig. 11).

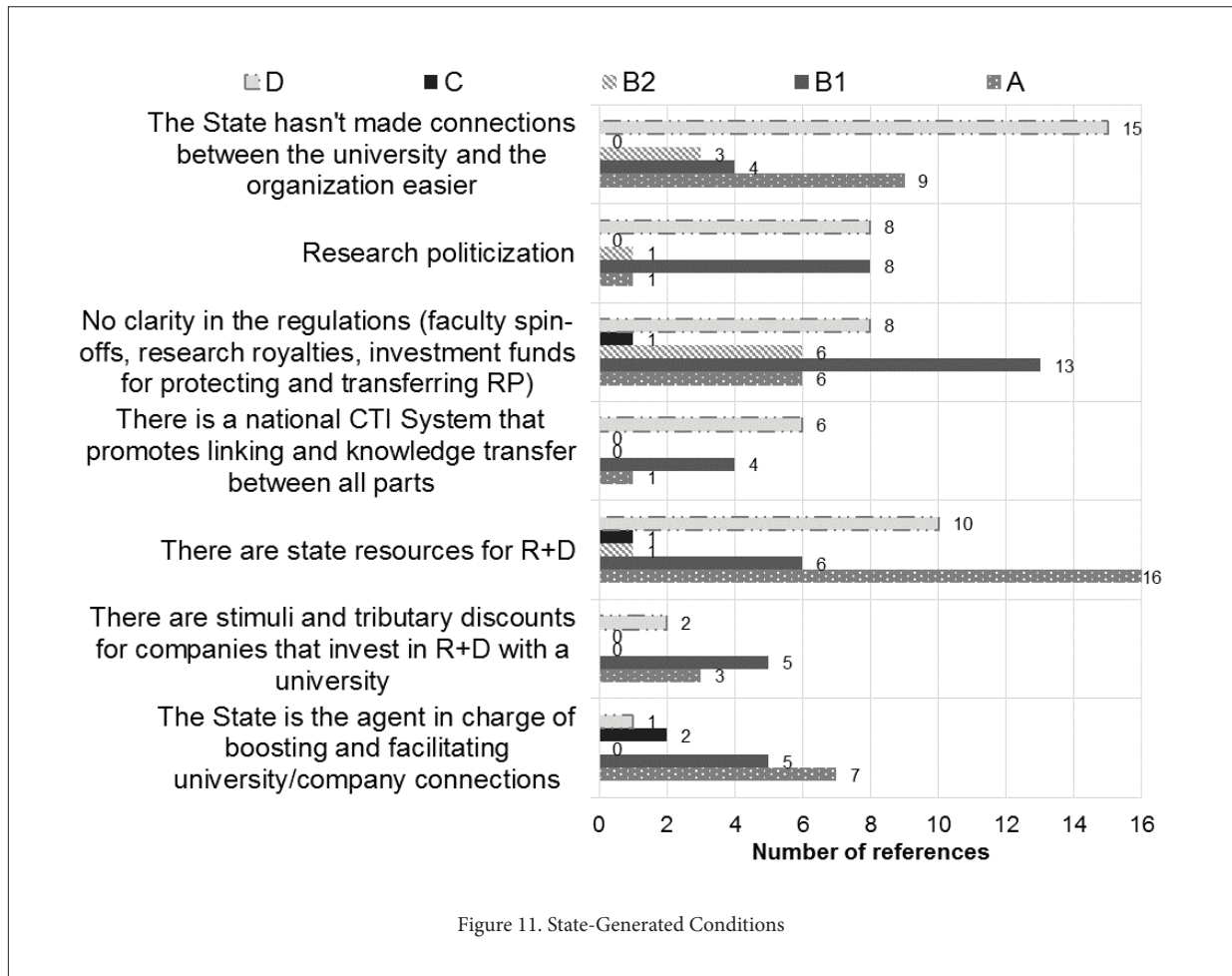


Figure 11. State-Generated Conditions

University A stands out on the Society-generated conditions in their aversion to risk (Jaramillo, 2005; Vestergaard, 2007; Garcia, 2008) which is associated with the fact that there is an uncertainty in investing resources in scientific developments. On the other hand, Universities A and B2 identify resources for research are scarce (in spite of State efforts). Universities B2 and C indicate that there are barriers for commercializing developments due to cultural resistance, high cost or competitiveness in the market. Opposing what has been said before, Universities B1 and D see a more favorable environment since they have several entities supporting their RC endeavors and they also have the same societal challenges to generate applied knowledge as the others.

Thus, surroundings conditions significantly impact the development of CR in universities. The State is the one handing out resources

for research, but it does not establish a clear and sustainable system R+D and the general academia-industry-environment relationship. The productive sector is also cautious in developing research with universities and the technology appropriation, in spite of all of this, the cases that were subjected to study show an effective CR model even though the environment may not be the best because of integration barriers between science and technology developers and organizations.

### Discussion

The selection of driving factors came down to those who had more references during the interviews conducted as well as those with more incidence in RC and RTRC (table 7).

Table 7. Determining Factors in Research Results Transfer in Collaborative Research

Participant's Profile		
Researcher's profile		Researcher's position
Committed to the needs of the productive ally		Open to participate in research agreements, committees, incubator extensions and collaborative R+D
Student's profile		Student's Position
Linked to the project through research		Takes part in project transference (researcher and organization interaction)
		Obtained a space to realistically apply school knowledge
Organization's Profile		Organization's position
Belongs to private sector		Links are made via trust relationships
Big Companies		
University conditions		
Focus	Linking Units	Linking unit personnel profile
Joint R+D with productive sector	Research groups	Ability to unite researchers and productive sector organizations
Technical and Scientific personnel training	National-Level Units (Colciencias, Innpulsa, Ministries, etc.)	Negotiation skills
	Research or Technological transfer/IP Office	knowledge on industrial intellectual property
University Policies		
The university encourages patenting		
The university creates action plans, programs, projects and call-outs for Collaborative Research and Knowledge transfer		
The university has a director's board that is open to changes		
Establish an active relationship with their surroundings through diverse channels		
There is a plan to follow-up on linking development		
R+D Process		
Linking mechanisms or strategies		
E-U Formal structure (agreements, contracts)		Establishing Formal relationships Academia-Environment
R+D motivation		
The pursuit of knowledge application in a real context		Useful subject selection in terms of social context
Planning		
Objectives, time frame, scope, costs, quality and project risks and strategies are set		
Medium conditions		
Organizational conditions		
Organizations see that universities have the potential to be useful		
State Conditions		
The State has R+D resources		
Environment conditions		
Economic openness and global competitiveness of the markets drive university-productive sector synergy		



Participant profile shows an openness to establish CR relationships, which has driven the university to generate capabilities to support these processes (from adopting a focus towards CR complementary to formation activities to creating policies that go in favor of the profile of the entrepreneurial university) and seek to position themselves as an institution that actively participates in the innovation system of the region (Colyvas, 2007).

The existence of linking or transfer units favors CR and RTCR due to the fact that it serves as an integrating mechanism among the main actors. These units are important on several levels: research groups, internal transfer offices or units that facilitate financing processes and management to the national level.

CR and RTCR processes start by creating a trust relationship (informal) between the two parts and then formalizing it by a strict planning process that generates total clarity according to project expectations.

The main motivation of universities when generating links between academia and the productive sector is the contribution of science to a real context and the generation of a benefit to society.

The results of the universities that were subjected to study, are coherent with the general aspects found in the literature on CR and RTCR processes, however, state and appropriation of R&D in the different cases of study are aspects in which barriers are present, this is due to the fact that the results have not been transferred in its totality in spite of the industry's interest.

Finally, organizations now visualize the activities in universities more closely as integrators of their internal processes to which they are more interested in the knowledge offer they may bring. State powers the system with R&D resources and the market pulls towards the use of knowledge as a factor of productivity and competitiveness.

## Acknowledgements

University employees linked to the different participating universities: Universidad Nacional de Colombia in Bogotá and Medellín, Universidad de Antioquia, Universidad del Valle in Cali and Universidad Militar Nueva Granada in Bogotá, as well as the employees of the participating companies who offered their time and knowledge to identify the different cases and describe the transference experiences in which they had been part of. Also Mr. Danilo Nava, for translating this document. This is a research article derived from the INV ECO 1480 Project: Determining factors in the transference of research results via Collaborative Research towards the productive sector in four Colombian public universities. Funded by Research Vice dean in Universidad Militar Nueva Granada, 2014 validity.

## References

- Acevedo, M., González, O., Zamudio, L., Abello, R., Camacho, J., Gutiérrez, M., . . . Baeza, Y. (2005). Un análisis de la transferencia y apropiación del conocimiento en la investigación de universidades colombianas. *Investigación y Desarrollo*, 13(1), 128-157.
- Arvanitis, S., Kubli, U., & Wörter, M. (2011). Knowledge and Technology Transfer Activities between Firms and Universities in Switzerland: An Analysis Based on Firm Data. *Industry and Innovation*, 18(4), 369-392. doi: 10.1080/13662716.2011.573956
- Azagra, J. (2003). *La contribución de las universidades a la innovación: Efectos del fomento de la interacción universidad-empresa y las patentes universitarias*. (Doctoral), Universitat de Valencia, Valencia.
- Bjerregaard, T. (2009). Universities-industry collaboration strategies: a micro-level perspective. *European Journal of Innovation Management*, 12(2), 161-176. doi: doi:10.1108/14601060910953951
- Bozeman, B. (2000). Technology transfer and public policy: a review of research and theory. *Research Policy*, 29(4-5), 627-655. doi: http://dx.doi.org/10.1016/S0048-7333(99)00093-1
- Burnside, B., & Witkin, L. (2008). Forging Successful University & Industry Collaborations. *Research-Technology Management*, 51(2), 26-30.
- Cabrero, E., Cárdenas, S., Arellano, D., & Ramírez, E. (2011). La vinculación entre la universidad y la industria en México: Una revisión a los hallazgos de la Encuesta Nacional de Vinculación. *Perfiles educativos*, 33, 187-199.
- Colyvas, J. A. (2007). From divergent meanings to common practices: The early institutionalization of technology transfer in the life sciences at Stanford University. *Research Policy*, 36(4), 456-476. doi: http://dx.doi.org/10.1016/j.respol.2007.02.019
- D'Este, P., & Patel, P. (2007). University-industry linkages in the UK: what are the factors underlying the variety of interactions with industry? *Research Policy*, 36(9), 1295-1313.
- Davies, H., Nutley, S., & Walter, I. (2008). Why 'knowledge transfer' is misconceived for applied social research. *J Health Serv Res Policy*, 13(3), 188-190. doi: 10.1258/jhsrp.2008.008055
- Decter, M., Bennett, D., & Leseure, M. (2007). University to business technology transfer—UK and USA comparisons. *Technovation*, 27(3), 145-155. doi: http://dx.doi.org/10.1016/j.technovation.2006.02.001
- Dooley, L., & Kirk, D. (2007). University-industry collaboration: Grafting the entrepreneurial paradigm onto academic structures. *European Journal of Innovation Management*, 10(3), 316-332. doi: doi:10.1108/14601060710776734
- Fernández, I., Castro, E., Conesa, F., & Gutiérrez, A. (2000). Las relaciones universidad-empresa: entre la transferencia de resultados y el aprendizaje regional. *Revista Espacios*, 21, 127-147.
- Fernández López, S., Otero González, L., Rodeiro Pazos, D., & Rodríguez Sandiás, A. (2009). Determinantes de la capacidad de las universidades para desarrollar patentes. *Revista de la educación superior*, 38, 7-30.

- Garcia, G. A. (2008). La propiedad intelectual en las economías universitarias. *Revista De La Facultad De Derecho y Ciencias Políticas*, 38(108), 53-72.
- Geiger, R. L., & Creso, S. (2005). Beyond technology transfer: US state policies to harness university research for economic development. *Minerva*, 43(1), 1-21.
- Gertner, D., Roberts, J., & Charles, D. (2011). University-industry collaboration: a CoPs approach to KTPs. *Journal of Knowledge Management*, 15(4), 625-647. doi: doi:10.1108/13673271111151992
- Hanel, P., & St-Pierre, M. (2006). Industry–University Collaboration by Canadian Manufacturing Firms\*. *The Journal of Technology Transfer*, 31(4), 485-499. doi: 10.1007/s10961-006-0009-5
- Heidrick, T. R., Kramers, J. W., & Godin, M. C. (2005). Deriving Value from Industry-University Partnerships: A Case Study of the Advanced Engineering Materials Centre. *Engineering Management Journal*, 17(3), 26-32. doi: 10.1080/10429247.2005.11415294
- Jaramillo, L. J. (2005). *Las políticas universitarias: para la promoción de vinculaciones con el sector empresarial en I&D Caso de Colombia : documento de trabajo*: Asociación Colombiana de Universidades.
- Kazumasa, K. (2009). University-Industry Research Collaborations of Small-Medium Enterprises - An Insight from Japan. *IETE Technical Review*.
- Krücken, G., Meier, F., & Müller, A. (2007). Information, cooperation, and the blurring of boundaries – technology transfer in German and American discourses. *Higher Education*, 53(6), 675-696. doi: 10.1007/s10734-004-7650-4
- Lai, W.-H. (2011). Willingness-to-engage in technology transfer in industry–university collaborations. *Journal of Business Research*, 64(11), 1218-1223. doi: http://dx.doi.org/10.1016/j.jbusres.2011.06.026
- Lakpetch, P., & Lorsuwanarat, T. (2012). Knowledge transfer effectiveness of university-industry alliances. *International Journal of Organizational Analysis*, 20(2), 128-186. doi: doi:10.1108/19348831211227819
- Lee, Y. (2000). The Sustainability of University-Industry Research Collaboration: An Empirical Assessment. *The Journal of Technology Transfer*, 25(2), 111-133. doi: 10.1023/A:1007895322042
- Lee, Y. S. (1996). 'Technology transfer' and the research university: a search for the boundaries of university-industry collaboration. *Research Policy*, 25(6), 843-863. doi: http://dx.doi.org/10.1016/0048-7333(95)00857-8
- Markman, G. D., Gianiodis, P. T., Phan, P. H., & Balkin, D. B. (2005). Innovation speed: Transferring university technology to market. *Research Policy*, 34(7), 1058-1075. doi: http://dx.doi.org/10.1016/j.respol.2005.05.007
- Meyer-Krahmer, F., & Schmoch, U. (1998). Science-based technologies: university–industry interactions in four fields. *Research Policy*, 27(8), 835-851. doi: http://dx.doi.org/10.1016/S0048-7333(98)00094-8
- Morandi, V. (2013). The management of industry–university joint research projects: how do partners coordinate and control R&D activities? *The Journal of Technology Transfer*, 38(2), 69-92. doi: 10.1007/s10961-011-9228-5
- OECD. (2004). *Patents and Innovation: Trends and Policy Challenges*. Paris: OECD Publishing.
- Payumo, J., Gang, Z., Pulumbarit, E., Jones, K., Maredia, K., & Grimes, H. (2012). Managing intellectual property and technology commercialization: Comparison and analysis of practices, success stories and lessons learned from public research universities in developing Asia. *Innovation*, 14(4), 478-494. doi: 10.5172/impp.2012.14.4.478
- Perkmann, M., & Walsh, K. (2007). University Industry Relationships and Open Innovation: Towards a Research Agenda. *International Journal of Management Reviews*, 9(4), 259-280.
- Pineda, K., Morales, M., & Ortiz, M. (2011). Modelos y mecanismos de interacción universidad-empresa-Estado: retos para las universidades colombianas. *Revista Universidad de La Salle*, 56, 41-67
- Ponomarev, B., & Boardman, C. (2008). The effect of informal industry contacts on the time university scientists allocate to collaborative research with industry. *The Journal of Technology Transfer*, 33(3), 301-313. doi: 10.1007/s10961-007-9029-z
- Ramos-Vielba, I., & Fernández-Esquinas, M. (2012). Beneath the tip of the iceberg: exploring the multiple forms of university–industry linkages. *Higher Education*, 64(2), 237-265. doi: 10.1007/s10734-011-9491-2
- Saavedra, M. (2009). Problemática y desafíos actuales de la vinculación universidad empresa: El caso mexicano. *Actualidad contable FACES*, 12(19), 100-119.
- Siegel, D. S., Waldman, D. A., Atwater, L. E., & Link, A. N. (2004). Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: qualitative evidence from the commercialization of university technologies. *Journal of Engineering and Technology Management*, 21(1–2), 115-142. doi: http://dx.doi.org/10.1016/j.jengtecman.2003.12.006
- Silvernagel, C., Schultz, R. R., & Moser, S. B. (2009). Student-generated intellectual property: perceptions of ownership by faculty and students. *Journal of Entrepreneurship Education*, 12, 13-33.
- Thune, T. (2009). Doctoral students on the university–industry interface: a review of the literature. *Higher Education*, 58(5), 637-651. doi: 10.1007/s10734-009-9214-0
- Vestergaard, J. (2005). *Innovation and university interaction with industry in Colombia : policies, experiences and future challenges* W. Bank (Ed.) (pp. 113).

# Mapping the Connection between Knowledge Transfer and Firm Competitiveness: An Empirical Research in the Basque Country

Javier Benito-Bilbao <sup>1 \*</sup>, Francisco Sánchez-Fuente <sup>2</sup>, José Ramón Otegi-Olaso <sup>3</sup>

**Abstract:** Knowledge transfer (KT) is a wide and complex phenomenon enclosed in the subject of knowledge management which encompasses some related concepts such as knowledge exchange, knowledge sharing, knowledge interfacing and knowledge flow. Presently, KT is one of the most appealing topics in the field of business and economics due to the connection with innovation and business growth that raises the interest and expectancy of diverse institutions and companies on this practice. Many studies about the theme: concept, characteristics and composing elements have been written during the last two decades, and researchers have tried to depict models to represent KT drawing on the different perspectives of the phenomenon, and focused on varied contexts. Connection of knowledge transfer, innovation, and competitiveness has already been revealed, and evidence of a close relationship between effective impact of KT processes, successful innovation, and higher business performance has already been found out. Therefore, identifying the basic keys of the phenomenon of KT which moderate the impact on business competitiveness will become a noteworthy contribution to the business and innovation management field. The aim of this research is to describe the connection between KT and firm competitiveness through the listing of the main business keys to take into account when planning and performing KT operations. For this purpose, firstly, we develop a conceptual framework of the KT phenomenon, drawing upon a distinguished theoretical KT model which links the determining factors and the impact. Afterwards, we elaborate a survey of questions framed in the model, in order to proceed with an empirical fieldwork based on qualitative interviews with companies and institutions sited in the Basque Country and whose KT activities are frequent and heterogeneous. The qualitative research lets us explain the findings, and state the conclusions of the study, bringing to light a direct link between KT impact and the extent of competitiveness of a company, and revealing a set of main success factors to increase business performance: suitable design and implementation of mechanisms to perform KT, effective cooperation between players, skilled management of the mix of knowledge, and propitious organisational culture.

**Keywords:** Knowledge transfer; firm competitiveness; business performance; knowledge transfer impact; innovation success.

Submitted: August 6th 2015 / Approved: December 4th 2015

## Introduction

Knowledge transfer (KT) is a topic of current interest and fascination which raises debates among the diverse stakeholders involved in this field. All researchers and experts states that it is a core subject of the political agendas of the major industrial countries when developing public programs related to economic growth, entrepreneurship, third mission of the university, innovation, etc.. This is attributed mainly to the double role of KT in the economy: 1) as the prime facilitator to enable conversion of science and technology outcomes in market innovations; 2) as a key role for the generation, deployment and consolidation of organizational units that leverage knowledge, of all sorts of sources, for the improvement, expansion, and profitability of the investments, by extending best practices, disseminating procedures, exchanging data and information, etc ... (Argote and Ingram, 2000, p.164-165).

KT is a complex phenomenon (Bozeman, 2000, p. 627) which could be broken down into a multiple set of elements (Kumar and Ganesh, 2009, p.165-169), and which requires an analysis under diverse streams of research that approach this topic matter (Graham, 2008,

p-13-15), since the extensive existing literature draws upon theories on engineering, social sciences and business administration. Therefore, KT could be deemed as a multifactor phenomenon, whose study forces to follow a holistic and eclectic perspective of the issue. Likewise, bibliography points at KT as a crucial element in economic and social development (Bozeman, 2000, p. 646-647; Bozeman et al, 2015, p. 6), and as the key to improve the competitiveness of companies, institutions, and communities in general. This term is used to stress that various communities are involved: not only business, but all communities. Entities may turn internal and external knowledge into competences after implementing knowledge management policies and processes.

As well, authors have already found evidence about the influence of KT in achieving successful innovations (Spencer, 2003, p-230-231), and improving business results (Dyer and Nobeoka, 2000, p.364-365). Therefore, KT is a business practice with a direct derivative in sustainability and competitiveness of the companies. In fact, the more dependant on knowledge assets is an organization, the more influence KT events have in its viability. Therefore, thanks to the successful impact of a KT operation, a company could attain a unique im-

1 Business Management and Innovation, University of Basque Country. Spain

2 Department of Business Management, Faculty of Engineering, Basque Country University, Spain.

3 Department of Engineering Projects and Graphic Expression, Faculty of Engineering, Basque Country University, Spain.

\*Corresponding author: jbenito007@ikasle.ehu.es



provement of performance, but when the same company carries out systematic and structured KT activities, which means that this firm underpins knowledge assets as strategic resources (Hoopes and Postrel, 1999, p.838), the competitiveness steadily increases. This theory is particularly appealing for those entities belonging to medium-high and high technological intensity industries, such as biotechnology, information and communication technologies, scientific instrumentation, knowledge-intensive business services, and aeronautics. For all these institutions and firms, the extent of success in their existence and development is closely linked to knowledge assets as principal resources (Grant, 2002, p.145-146)

In parallel, we can find certain business facts described in numerous reports of institutions and associations warning about the existence of a strong elasticity among: the degree of public support for the implementation of research, development and innovation (R&D&i), the recruitment of qualified staff, the creation of added-value capacities in companies, and the degree of internationalization, competitiveness, and resistance to situations of crisis or bearish economic cycles. However, other reports, state a lack of proportionality among: the budgetary dimension of public investment in research, development and innovation (R&D&i), the amount of scientific production, the volume of registration of intellectual and industrial property, and the set of indicators and metrics about: innovative firms, business competitiveness, export figures, and internationalization ratios. That is, while all stakeholders recognize knowledge as a critical resource, mainly when sourced from scientific origin, for the success of organizations, and macroeconomic impact for society is proved, there is no consensus in addressing solutions to mitigate and redirect those causative roots for not obtaining balance between business performance and budget effort allocated. The European Research Area Committee (ERAC) is a strategic policy advisory committee that advises the Council, the Commission and member states on research and innovation issues that are relevant to the development of the European Research Area. A report thereon issued by the ERAC (2014), and delivered to the Ministry of Economy and Finance of Spain, points to several reasons pertaining to: design of suitable public policies, more efficient cooperation between actors, improving current funding system, and evolving the business culture. It is seen, therefore, that too large amounts of public and private funds dedicated to enterprises and operations around business innovation, unfortunately, does not achieve the final desired goal, because a global KT approach may be required to be highly effective in the impact.

In closing, impact is the final target of any entity performing KT activities and operations, because it entails successful innovations, increase of business performance and, consequently, gaining competitiveness. Achieving satisfactory impact of KT is a direct consequence of the management of the set of its influential and determining factors (Comstock et al, 1999, p.23-24). Thus, verifying the connection between KT and competitiveness, and revealing the specific factors which characterise the optimal administration and execution of the whole KT operations within an entity, would become a priceless instrument to enhance busi-

ness performance and firm competitiveness through: a) strengthening business processes; b) overcoming goals and business targets.

The aim of this research is to describe the connection between KT and firm competitiveness, following a theoretical and empirical research. The findings and conclusions will allow us to bring to light the direct link between KT impact and the extent of competitiveness of a company, and to reveal the major success factors to increase business performance, through the listing of the main business keys to take into account when planning and performing KT operations.

## Methodology

The research project is composed by three chained phases. Firstly, through a literature search, a globally recognized model of KT which explains the effect of the impact of a KT event is selected, and a conceptual framework associated is developed. Then, as part of the qualitative research, a survey of questions is designed in order to seek the connection between the elements composing the model and the impact attained. Finally, the empirical qualitative research is carried out by means of an analysis based on interviews with stakeholders of innovation management. The study at field level registers observations to confirm or refute the theory developed in the first stage of the investigation, which is embodied in the form of a framework, as representation of the socio economic phenomenon of KT. The research is conducted in a qualitative way, based on survey design techniques, interview execution guidelines, and handling unstructured materials, in order to obtain narrative registers about the analyzed phenomenon. This strategy permits: the exposure and explanation of the phenomenon, the absorption of all sort of feedback, and the analysis of the data collected from direct observation of the phenomenon under study, according to the paradigm of real and natural environment settings (Patton, 2003, p.6; Patton, 2005). The methodology is defined to let increase knowledge and understanding of the fact, and to depict it as a socioeconomic model of, both, theoretical and empirical nature.

At the first stage of the research, we seek a model representing the phenomenon of KT through the basic elements that moderate the result of the process of transferring knowledge, and which, at the same time, depicts the different goals and effectiveness criteria of the each KT process. This model is needed as a tool of information which supports us to define a survey of questions that fit in the dimensions of factors exhibited in the model, and to connect variables of KT performance, with the KT impact. This way, the survey will be complete and no decisive question about a component affecting KT effect will be ignored. With the aim of being precise in our search, we put a set of conditions to ensure that the chosen model is solid enough for our research purpose: 1) the selected model should have global acknowledgement among the scientific community of KT experts; 2) the selected model should have been reviewed and improved through amendments; and 3) the selected model should have been used for research studies, both theoretical in order to develop conceptual frameworks, and empirical in order to apply or define and execute KT experiments.



We follow the set of recommendations stated by Graham, (2008, p.24-26), in order to spot scientific journals that include KT field among the editorial objectives and thematic priorities. The review and analysis of scientific articles allows us to identify a model accomplishing our conditions and premises. The selected model is the model of technology transfer proposed by Bozeman (2000, p. 636), called “contingency effectiveness model of technology transfer”, (Bozeman, 2000, p.636), which has also be amended later by the author in the “revised contingency effectiveness model of technology transfer (Bozeman et al, 2015, p.3). This is a well-known and globally accepted model which lets researches and practitioners study technology transfer processes in diverse sciences branches. In fact, Bozeman’s model, or the contingent effectiveness model, has been numberless used for researches on the issue, and it has also has been utilized in application, or, as a conceptual framework in a wide variety of articles, ranging from industrial ecology to higher education innovations to transfer of vaccines (Ramakrishnan, 2004; Bailey and Mouton, 2005; Sebastian, 2008; Al-bors et al, 2009; Mohammed et al, 2010; Hendriks, 2012; Kitagawa and Lighttower, 2013). The author himself expresses this fact in the report: Technology Transfer Research and Evaluation: Implications for Federal Laboratory Practice, Final Report to VNS Group, Inc. and the U.S. National Institute of Standards, April 4, 2013. The contingent effectiveness model is representative of the KT socioeconomic phenomenon, and it is showed using a suitable abstraction scale in order to remain represented all types of KT events and potential results.

Thanks to own former research studies carried out, we can explain the main dimensions or master determining factors affecting KT impact (Benito-Bilbao et al, 2015, p. 37-38). These factors, whose characterization has some extent of influence in the celebration of KT and consequently impact on the final outcomes obtained, are (Figure 1):

- Attributes of external context, or characteristics out of the internal framework of a KT event.
- Attributes of the object of knowledge, or characteristics of complexity of the piece of knowledge asset that is subjected to a KT process or operation.
- Attributes of the actors involved in the KT, or senders and receivers of the object of knowledge, who have certain intellectual and emotional features as individuals, and certain organizational and structural features as collectives.
- Attributes of the relationship between actors, or characteristics of the interactions and relations that all the actors play during a KT operation or event.
- Mechanisms of means, as those tools and instruments of all types which carry, support, enable and materialize the operation of a KT event.
- Mechanisms of strategy and corporate management, as those tools and instruments of all types which conduct, guide, handle and steer a KT event.
- Impact, since each KT event leads to a series of results and consequences.

The figure 1, showed below this paragraph, displays a KT phenomenon from the point of view of the dimensions of determinants of impact. Thus, KT is triggered when actors of certain characteristics commence to keep relationships and interactions activities to let flow a specific object of knowledge. These operations are enabled thanks to a bundle of internal mechanisms which conduct and support the event. All the stated elements distinguish a particular KT phenomenon complemented by the characteristics of the external environment where they are framed. The result of the dynamic of the set of elements is the specific outcomes or impacts of KT phenomenon, and its extent of success is particularly affected due to the interaction of the multiple factors composing each element, denoting KT is a large, complex, multifactor and tangled event (Bozeman, 2000, p.637; Grant, 2002, p.136; Kumar and Ganesh, 2009, p. 165-169; Bozeman et al, 2015, p.1-2).

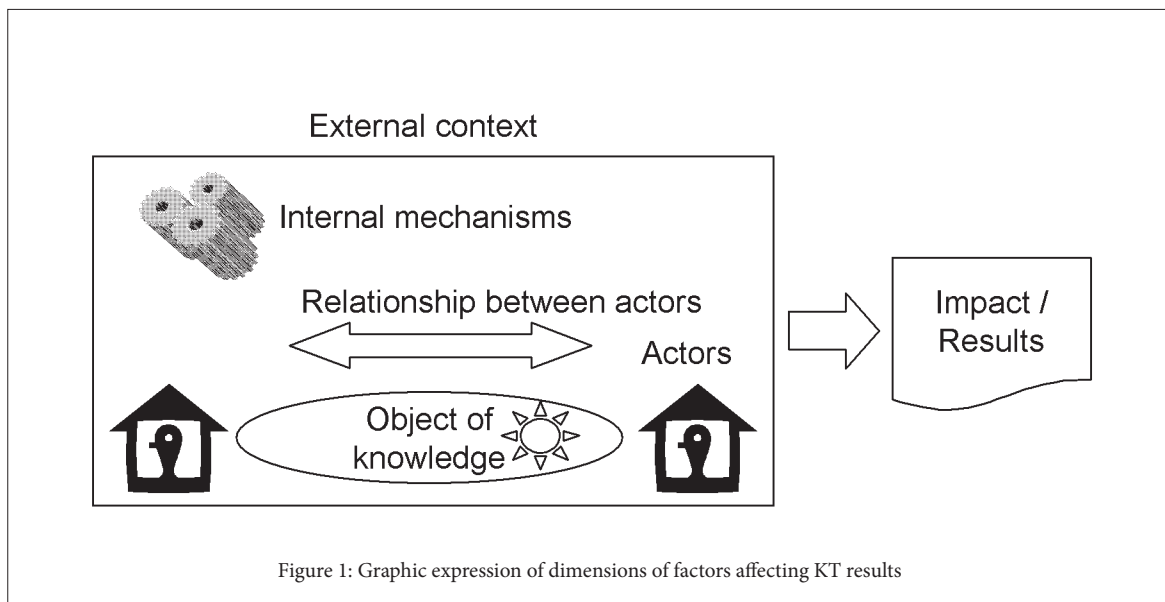
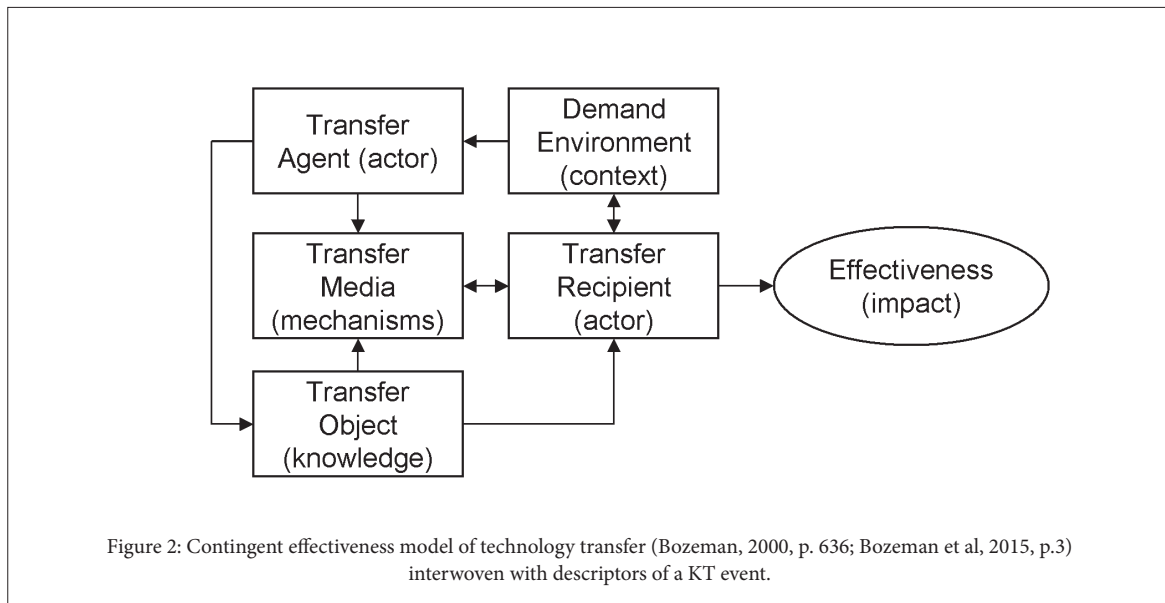


Figure 1: Graphic expression of dimensions of factors affecting KT results



As stated above, the major descriptors of a KT event are: knowledge, actors, mechanisms, context, and impact. We can interweave Bozeman's model and the descriptors as displayed in Figure 1.



We compare and match the contingent effectiveness model (Bozeman, 2000, p.636; Bozeman et al, 2015, p.3) with our researches on the topic (Table 1), and we display the conceptual framework that we will use for the empirical research (Table 1). This framework, or set of dimensions of determinants which moderates KT impact, is constant to any industry or sector in which the phenomenon happens, because

its formulation is characterized by a theoretical nature. It gathers the features defining a KT event: knowledge, actors, mechanisms, context and impact, and also the diverse kinds of impacts for a KT event. Always, the results are consequence of some of the myriad factors included in those dimensions. In conclusion, the qualitative research will be powered by the conceptual framework which is composed by a set of managerial factors comprehensible for the interviewees.

Table 1: Conceptual framework of dimensions for empirical research

Matching Bozeman’s model with factors determining KT impact			
Transfer Object	Transfer Agent	Transfer Media	Demand Environment
	Transfer Recipient		
KT Effectiveness			
KT Impact			
Attributes of the object of knowledge	Attributes of the actors	Mechanisms of means	Attributes of external context
	Attributes of the relationship between actors	Mechanisms of strategy and corporate management	
Conceptual framework for the empirical research			
Object of knowledge	Actors and relationships	Internal mechanisms	External context
Impact			

At the second stage of the research, we develop the questions to use during the interviews with the entities involved in the qualitative study. We match each question to the dimension in the conceptual framework

in order to ensure that every dimension is fully covered by the inquiring process. The tactic to explore the KT phenomenon is based in the contrast between theoretical dimensions obtained during the first stage of

the research, and the behavioural characteristics in the real context (Patton, 2002, p.5, p. 11). Interviews are considered social interactions whose aim is to retrieve data for later processing and drawing conclusions (Roulston, 2013, abstract) and the results are descriptions of observed situations and manifestations described by the actors. In order to leverage the power of the interview, the array of questions of the survey should

be open enough to let the interviewee explain the details of the empirical experience of the entity when transferring knowledge, but close enough to get the interviewer collect real data of the phenomenon at all levels. So, face-to-face interviews will be aided by a semi-structured survey guide (DiCicco-Bloom and Crabtree, 2006, p.315), in the same environment where KT events happen intensively.

Table 2: Survey of questions for qualitative research interviews

Question	Dimension
Which is the role of KT within the institution/company?	Impact
Why is KT a strategic activity for your institution/company?	Impact
Which extent of success is the institution/company currently achieving when performing KT events and operations?	Impact
Which set of factors are affecting the results of KT? Remark the most influential factors.	All
Which are the critical assets of knowledge for the sustainability and competitiveness of the institution/company?	Knowledge
Which is the complexity of the knowledge assets and how do you manage it?	Mechanisms
Do you develop internal knowledge and capabilities? Do you capture external knowledge and capabilities?	Mechanisms
How do you ensure a successful knowledge transfer inter- and intra organizational? Both?	Mechanisms
Which mechanisms does the institution/company use to manage and govern KT events and operations?	Mechanisms
Which tools and instruments does the institution/company use to implement and perform KT events and operations?	Mechanisms
Do you effectively observe better business performance (measured through any kind of indicator) when KT is successfully performed?	Impact
Do you consider KT results are adding value to the institution/company? How do you perceive the value addition?	Impact
Which is the attitude and behaviour of the people of the institution/company towards KT activities?	Actors and relationships
Does the company/institution belong to collaborative or cooperative networks with the aim of exploring and exploiting knowledge?	Mechanisms
How are the interactions and relationships between you institution/company and other entities when operating KT activities?	Actors and relationships
Which concrete improvement, if exists, is KT procuring?	Impact

At the third stage of the work, the empirical qualitative research is carried out by means of an assessment and analysis based on interviews with stakeholders of innovation management. The objective of this step is to disclose the connection between the dimensions of factors moderating KT, and the extent of business performance and competitiveness attained. Given that the conceptual framework is simple in appearance but complex in its real content, a qualitative research interview (Flick, 2014) is considered as the most appropriate technique for this stage.

The selection of the group of institutions and companies is done: 1) following the guidelines stated by DiCicco-Bloom and Crabtree (2006, p.316-319) in order to get a homogeneous sample of individuals; and 2) taking into consideration the scope proposed by Etzkowitz

and Leydesdorff (2000, p. 111-113) to ensure that the full spectrum of the topic is covered from the diverse approaches, and a heterogeneous vision is achieved. Thus, the panel of respondents exhibits all the social, economic and business environments affected. We select 9 institutions with large empirical and practical KT background, and deeply immersed in an intense KT atmosphere: 3 high-tech clusters representing knowledge-intensive and high technology industries; 2 universities representing the higher education environment and science system, 2 non-profit technology corporations representing research and technology system, and 2 public institutions in charge of fostering innovation representing public policies system. For each institution or company we invite a interviewee, who should be a person of the board of directors (chief executive officer, dean, managing director, etc...)

## Results

We proceed to the empirical research through a scheduled set of qualitative research interviews with institutions and companies in charge of performing a systematic range of KT events and operations. The aim of the work is to reveal the details of the major keys enabling KT effectiveness, innovation success, and competitiveness of the organisations. The table 3 shows the results obtained after summarizing, processing and tabulating the information captured during the interviews, once allocated according to the dimensions of the framework previously established: object of knowledge, actors and relationships, external context, internal mechanisms, and impact.

Finally, as final fruit of the research process, we reveal the list of empirical factors moderating KT impact, the innovation success and the extent of competitiveness attained by an organisation (Table 4). The factors are classified and categorized according to each dimension of the framework and, also, according to Bozeman's model (Bozeman, 2000, p.636; Bozeman et al, 2015, p.3). Thus, we integrate the results of the research with the theoretical model proposed by Bozeman, conceiving a richer model in terms of lower abstraction of the busi-

ness terms described as drivers for KT effectiveness. As Bozeman states (Bozeman, 2000, p. 644-648; Bozeman et al, 2015, p.4-8), effectiveness criteria are dispersed, and could be accomplished due to: market impact, economic development, political reward, public value, and scientific and technical skills, and human capital. Regarding the empirical impact observed by the interviewees, the research results cover the different criteria set by the expert. Thereby, traceability of the complete process is exhibited: from key factors moderating KT effectiveness until competitiveness. The business terms are, indeed, the keys to enable higher business performance and competitiveness for those entities in which knowledge assets act as strategic resources. The competitiveness is attained thanks to successful innovation, and originally, thanks to effectiveness in KT activities. The scheme represented in Figure 3 is the contribution that our study claimed to obtain, along with the empirical evidence brought to light about a close relationship between KT, innovation, business performance, and competitiveness (Hoopes and Postrel, 1999, p.839; Dyer and Nobeoka, 2000, p.364-365; Argote and Ingram, 2000, p.165; Spencer, 2003, p.230-231; Easterby-Smith and Lyles, 2012, p. 15; Ding, 2013, p.101). Therefore, this depiction may become a useful and practical instrument for corporative business management.

Table 3: Results of the qualitative research tabulated according to the conceptual framework

Type of institution/ company	Object of knowledge	Actors and relationships	External context	Internal mechanisms	Impact
High-Tech Cluster	Highly specialized knowledge. Complex knowledge.	Commitment with KT. High-tech facilities required. Attitude towards innovation and internal/external collaboration. Partnership-based strategy. Long-term collaboration. Bidirectional flows of knowledge with partners. Joint ventured relationships. Culture of common understanding. Culture of industrialization.	Support of public policies. Involvement of public entities.	Open innovation strategy. Large networks and multi-profile actors to enhance cooperation. Outsourcing strategy for partnerships and relations. Contributions structured, systematized and long-term addressed. Inter industrial flows of knowledge. Knowledge value chain rules the internal organisation. Intellectual property management.	Increasing individual and collective capabilities of the actors. Increasing overall business performance of the institution/company. Increasing internal process efficiency.
High-Tech Cluster	Knowledge and technology specialized.	Management of human capital and talent of people. Knowledge embodied in people. Culture of technology transfer.		Strategy to exploit commercially the scientific knowledge. Management of intellectual and industrial property. Structured and intensive R&D activities at corporate level. Integration of KT into innovation system.	Increasing collaborative and cooperative capacities. Increasing innovation success. Increasing organisational capabilities. Increasing value creation for the market.
High-Tech Cluster	Knowledge structured and codified for transferring.	Culture of transfer. Attitude and aptitude of individuals. Motivation and commitment to transfer and innovation. Hierarchical organization. Organisational culture to cooperate.	Socio-economic value of KT activities, innovation and R&D.	Science-industry strategy. Alignment of R&D and business operations. Mechanisms to incentive attitude. Technology resources to structure and tangibilize knowledge. Suitable collaborative models for KT. Mechanisms to manage KT and innovation. Methodologies to measure impact and extent of KT success.	Increasing organisational capacities and business efficiency.

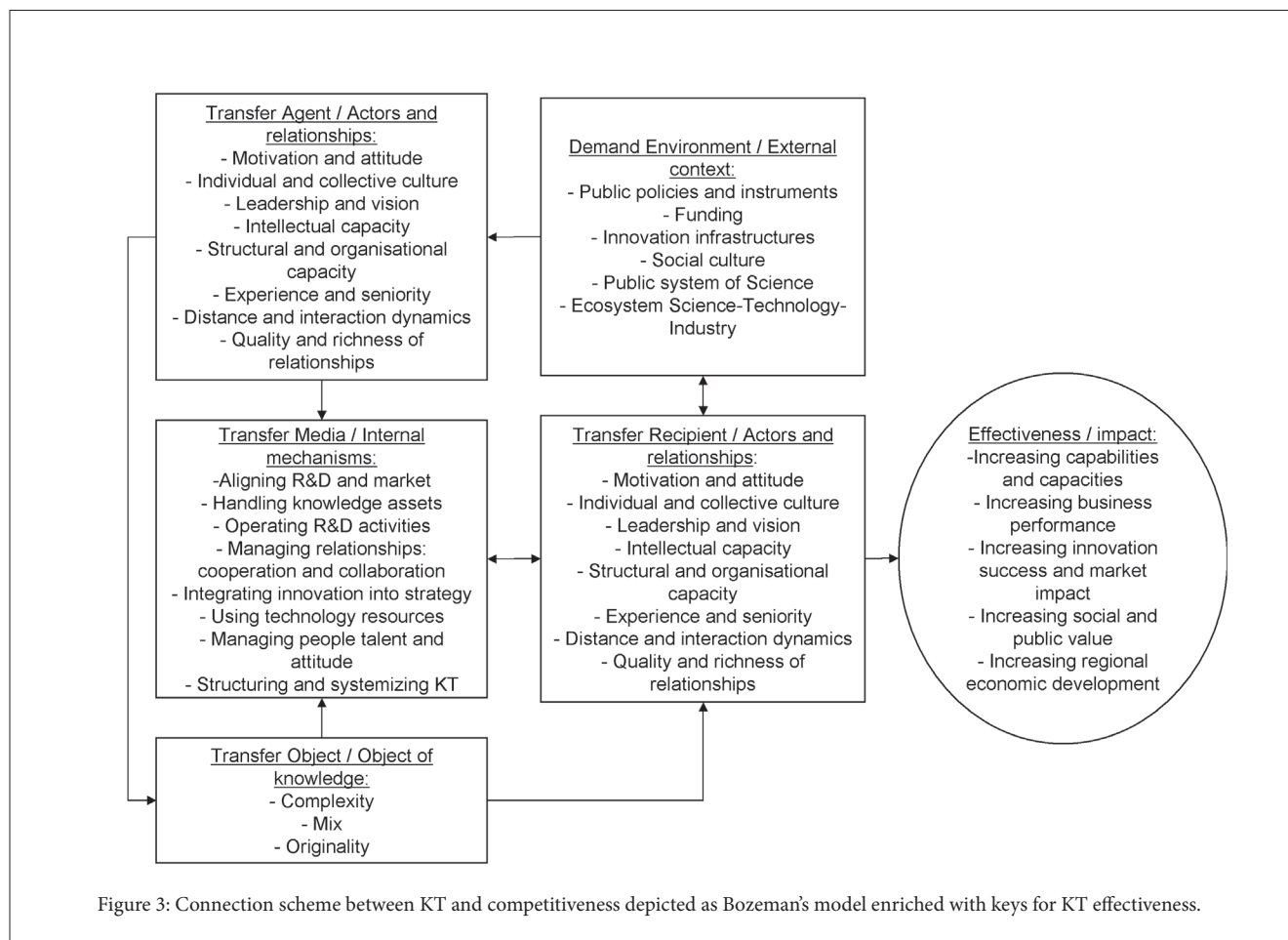
Research & Technology Corporation		Size of the institution. Background and former successful experiences of KT. Structured and systematic R&D and innovation activities. Organisational culture and commitment to innovation. Closeness and fluent interactions with partners. Climate of reliance and confidence between actors.		Cooperation based on partnerships and long-term relationships. Scientific-technological cooperation of actors with diverse capabilities and expertises. Planning of R&D and innovation strategy commonly designed. Achieving excellent highly specialized R&D outcomes. R&D strategy oriented to market and business needs.	Increasing political and social culture towards innovation. Increasing innovation success. Increasing quality of R&D outcomes applied to new goods development. Increasing competitiveness of the institution/company.
Research & Technology Corporation	Complex knowledge assets due to be composed by scientific-technological and socioeconomic elements.	Strategy to share knowledge. Open innovation and co-creation approach. Characteristics of sender and receiver organizations involved in KT.	Characteristics of all KT ecosystem: public policies; R&T system; industry	KT works as a business strategy tool. R&D addressed to procure value to the market. Cooperative and collaborative approach. Knowledge management systems.	Increasing social concern for innovation. Increasing economic development. Increasing sustainability of firms.
University		Culture of transfer. Aligning academic research plans and industry needs. Companies with capacity to absorb scientific and technological knowledge. Mutual knowledge and understanding between companies and research groups. Scientists to join companies.	Public science system structured and competitive. Diffusing the capabilities of the public science system. Improvement and professionalization of the entities supporting KT.	Knowledge generation focused on business needs. Mobility of researchers and scientists to industry. Intellectual and industrial property management. Enabling dynamic relations science-industry.	Increasing robustness of public science systems. Increasing collaborative capabilities between science and industry. Increasing base of knowledge about succeeding in KT and innovation.
University		Understanding and liaison between science production and industry needs. Capabilities and business acumen to leverage results of internal and external scientific research.	Interfacing structures to foster innovation and to enable knowledge flows. Harmonic and rich context of basic and applied knowledge. Balanced system of science, industry and innovation infrastructures. Scientific outcomes available and accessible to the industry. Public instruments to support KT activities.	Strategy of innovation and knowledge management. Implication and commitment to R&D and innovation. Abilities and capacities to operate knowledge-based activities. Intellectual and industrial property management. Systematic and structured management of KT. Mobility of scientists to companies. Corporate strategy to take into account and adopt scientific research results	Increasing social commitment and public awareness for knowledge development and innovation. Increasing management capabilities. Increasing effectiveness of application of R&D outcomes into new marketable products. Increasing organisational efficiency.
Public Policy Institution	Managing the complexity of knowledge through being tangible	Organisational culture of transfer and innovation. Size of the institution/company. Motivation and attitude of human resources. Business acumen and leadership of the top management. Fluent and common understanding between actors involved in KT.	Funding system for KT. Programmes and instruments developed by public institutions supporting KT. Ecosystem of KIBS to enable, foster and enhance KT. Stimulation of KT by means of shared activities among all stakeholders.	Commitment of the company/institution to innovation and KT. Consistency between business model and market opportunities/needs. Corporate strategy focused on developing products and services based on knowledge. Incentive mechanisms to get people involved and implicated. Mechanisms to get effective cooperation between actors. Knowledge management in the organization. Management of intellectual and industrial property. KT activities structured and systematized.	Increasing diffusion of best practices for innovation success and competitiveness. Increasing regional economic development. Increasing organisational capabilities to perform more successful innovations. Increasing socioeconomic awareness about innovation and knowledge. Increasing competitiveness.

Public Policy Institution		Culture of knowledge transfer. Relationships and links between scientific entities and companies. Bidirectional interactions between science-industry arenas		R&D results to be converted into market goods. Structuring KT activities. Cooperation based on business needs and market opportunities. Collaborative networks encompassing science-industry. Intellectual and industrial property management	Increasing individual capabilities of the actors. Increasing cooperative capabilities of the actors. Increasing business performance in: efficiency, profitability, and competitiveness. Increase organisational capabilities to achieve better innovations for the market. Increase competitiveness. Increasing organisational capacities for efficiency.
---------------------------	--	--	--	---	--

Table 4: List of empirical factors moderating KT impact, innovation success and competitiveness.

Object of knowledge	Actors and relationships	External context	Internal mechanisms	Impact
Complexity	Motivation and attitude	Public policies and instruments	Aligning R&D and market	Increasing capabilities and capacities
	Individual and collective culture	Funding	Handling knowledge assets	
	Leadership and vision	Innovation infrastructures	Operating R&D activities	Increasing business performance
Mix	Intellectual capacity	Social culture	Managing relationships and interactions: cooperation and collaboration	Increasing innovation success and market impact
	Structural and organisational capacity		Integrating innovation into strategy	
	Experience and seniority		Using technology resources	
Originality	Distance and interaction dynamics	Public system of science	Managing people talent and attitude	Increasing social and public value
	Quality and richness of relationships	Ecosystem science-technology-industry	Structuring and systemizing KT	Increasing regional economic development





## Discussion and implications

The purpose of the research is to revalidate the evidence of the direct relationship existing between KT, innovation and competitiveness, and also, to disclose the existence of a solid connection between the systemic and steady phenomenon of KT being performed inside a company or institution, and the extent of competitiveness achieved. The aim of the work is also to make available to stakeholders in the field of innovation, a scheme containing the major keys for KT effectiveness, successful innovation and better business performance. The major findings of the research are: ratification of the relationship KT-competitiveness; empirical evidence of that linkage discovered, and furthermore, connection mapped through key business management factors for KT effectiveness. Likewise, we observe that the link is revealed from a qualitative perspective, and thus, the quantitative extent of the relationship between KT and competitiveness should be tackled in future researches.

We have also elaborated a framework of dimensions of KT determinants which is based on characterizing factors of the phenomenon and theoretical evidence of factors moderating the KT impact for high-tech institutions and companies (Benito-Bilbao et al, 2015,

p.38). The framework is conceptually analogous to the contingent effectiveness model of technology transfer (Bozeman, 2000, p.636; Bozeman et al, 2015, p.3), showing, therefore, a concordance on the results of both schemes. This finding drives to the fact that the frame of dimensions of determinants covers the same spectrum of KT as the scope represented by the model of characterizing factors for KT. Implication is clear: we can address to the phenomenon of KT from both perspectives as a similar approach. Indeed, the possibility of analyzing and researching on KT from the perspective of dimensions of determinants is more appropriate to define a model for optimal KT, since it allows us to analyze the elements influencing the impact of the phenomenon.

The qualitative research confirms that all the empirical factors responsible of leading a company or institution to innovation success and increasing grade of competitiveness can be allocated among the dimensions of the conceptual framework designed to classify, process and analyze the results of the interviews. Therefore, another finding is that the frame exhibits properly the socio-economic phenomenon of KT, and each KT event is moderated by such mapped factors, so every element has decisive influence on the KT impact, and the extent of effectiveness is dependent on the conditions and circumstances of each

event or KT operation. As well, there is a short list of factors which are remarked by interviewees as the stronger keys for successful innovation and better business performance when operating KT processes: handling the complexity and the mix of knowledge assets; fostering systematic and intense interactions between actors; deploying a set of internal mechanisms to conduct the phenomenon, and define the KT strategy taking into account of all the perspectives of the situation.

The finding about the relationship between KT and competitiveness is confirmed in the research by all respondents. They all acknowledge that all KT event carried into effect has positive impact in terms of: increasing capabilities, capacities and skills of the individual and collective actors involved; increasing business performance by improving efficiency, reducing costs, etc; increasing innovation success and market impact thanks to the development of new goods fulfilling customers needs; increasing social and public value by means of enhancing awareness of culture of innovation and enlarging stock of knowledge; and increasing regional economic development thanks to the confluence of all benefits in the territory.

The discovery about the set of factors mapping the connexion between KT and competitiveness is a detailed outcome extracted from the empirical research. According to this finding, we could present these business keys as the dashboard to guide and enable organizations to adopt concrete measures and to optimize events of KT. The major keys detected to increase business performance and gain competitiveness are: 1) steering the organisation with leadership and hybrid vision science-business with the innovation and knowledge as fundamental pillars; 2) managing the talent and the motivation of the people to set a prone attitude and innovation culture; 3) structuring and systematizing KT to create the suitable scenario with resources and skills; 4) increasing the awareness of the organization with R&D activities and knowledge management to create goods, to develop further individual and collective capabilities, and to store experience and expertise; 5) managing interactions and relationships around the collaboration and cooperation to extend the scope of possibilities; 6) handling the complexity and the mix of knowledge assets; and 7) harnessing the external context of instruments and policies for the self benefit.

## Conclusions

KT is a phenomenon strongly linked to innovation and competitiveness which can be studied under two different approaches: characterizing factors, or determinants of its impact. The last is a most suitable technique to reveal the key elements which more influence have on the effectiveness of the KT events, and, thus, more intensely affect on the achievement of better business performance and increase of competitiveness. These key factors can be classified in accordance with the dimensions characteristics of KT and its effectiveness: knowledge, actors, mechanisms and external context. We disclose empirical evidence about a positive relationship between KT effectiveness and better business performance, and we present a scheme with the levers liable to turn KT activities into competitiveness: leadership and vision in innovation, talent of the people, organisational culture, systematic

R&D and knowledge management activities, capabilities and experience, collaboration and cooperation complexity and mix of knowledge assets, and external instruments and policies.

Multiple stakeholders in the field of innovation and business management may take advantage of the findings and implications. KT is a crucial management practice linked to competitiveness which should be seriously adopted by all companies and institutions living inside a knowledge-based atmosphere. Corporations and SMEs should gain awareness about KT, and particularly knowledge-intensive business services companies should lead the implementation of systems related to the set of key factors. Public institutions and policy makers should develop instruments and programmes in order to ensure that the key factors are understood and customized according to each reality. Innovation infrastructures should promote partnerships and networks to explore and exploit knowledge. Science system and universities should align R&D activities with market needs and trends, balancing basic and applied research. Finally, researchers on business management might progress in the study of KT issue and conduct empirical studies of statistical nature to validate of the extent of influence of each factor.

## Acknowledgement

Dr. Javier Benito-Bilbao (Ph.D.) is the corresponding author of the scientific article "Mapping the connection between knowledge transfer and firm competitiveness: an empirical research in the Basque Country". The writer holds a Ph.D., a M.B.A, a M.Sc., and a B.Sc. and a background of 17 years at management consulting firms, research centres and universities, and high-tech corporations acting as consultant and manager. Presently, the author is an independent consultant and researcher on business management and innovation, as well as, author and reviewer of scientific articles in the field of business management and innovation. The article is an outcome of the theoretical and empirical doctoral research process developed by the writer, whose aim was to design a model for optimal transfer of knowledge within Basque high-tech manufacturing and developing industries. The thesis was awarded Cum Laude in February 2015 after a doctorate process supervised by Dr. Francisco Sánchez-Fuentes (Ph.D.) and Dr. José Ramón Otegi-Olaso (Ph.D.), according to the terms and conditions of the Project Management – Euro MPM academic programme of the Department of Project Engineering and Graphic Expression of the Faculty of Engineering of the University of the Basque Country in Bilbao, Alameda Urquijo s/n, 48013, Bilbao (SPAIN).

The author notes that there is no conflict of interest, including any financial, personal or other relationship with third parties, other people or organizations that could inappropriately influence, or be perceived to influence this work. Likewise, there was no financial support for the conduct of the research and for the preparation of the article.

## References

Albors-Garrigos, J., Hervás-Oliver, J. L., & Hidalgo, A. (2009). Analysing high technology adoption and impact within public

- supported high tech programs: An empirical case. *The Journal of High Technology Management Research*, 20(2), 153-168. doi: 10.1016/j.hitech.2009.09.006
- Al-Gharibeh, K. M. (2011). The knowledge enablers of knowledge transfer: an empirical study in telecommunications companies. *IBIMA Business Review*, Vol 2011, Article ID 328944, 1-13. doi: 10.5171/2011.328944
- Anokhin, S., Wincent, J., & Frishammar, J. (2011). A conceptual framework for misfit technology commercialization. *Technological Forecasting and Social Change*, 78(6), 1060-1071. doi:10.1016/j.techfore.2010.12.005
- Argote, L., & Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes*, 82(1), 150-169. doi:10.1006/obhd.2000.2893
- Bailey, T., & Mouton, J. (2005). *A review of models of research utilisation* (Vol. 1). AFRICAN SUN MeDIA;
- Becker, M. C., & Knudsen, M. P. (2006). Intra and inter-organizational knowledge transfer processes: Identifying the missing links. *Danish Research Unit for Industrial Dynamics. Working Paper* (No. 06-32), Copenhagen Business School.
- Benito-Bilbao J., Sánchez-Fuente F. Otegi-Olaso J.R. (2015). Holistic model for an efficient knowledge transfer of high-tech firms. *International Journal of Business and Innovation*. 2(5), 1-26.
- Bosch-Sijtsema, P. M., & Postma, T. J. (2010). Governance factors enabling knowledge transfer in interorganisational development projects. *Technology Analysis & Strategic Management*, 22(5), 593-608. doi:10.1080/09537325.2010.488064
- Bozeman, B. (2000). Technology transfer and public policy: a review of research and theory. *Research Policy*, 29(4), 627-655. doi:10.1016/S0048-7333(99)00093-1
- Bozeman, B., Rimes, H., & Youtie, J. (2015). The evolving state-of-the-art in technology transfer research: Revisiting the contingent effectiveness model. *Research Policy*, 44(1), 34-49. doi:10.1016/j.respol.2014.06.008
- Comstock, G. L., & Sjolseth, D. E. (1999). Aligning and Prioritizing Corporate RD. *Research-Technology Management*, 42(3), 19-25.
- DiCicco-Bloom, B., & Crabtree, B. F. (2006). The qualitative research interview. *Medical education*, 40(4), 314-321. doi:10.1111/j.1365-2929.2006.02418.x
- Ding, Q. (2013). Inter-Partner Interactions and Knowledge Transfer Mechanisms in the Chinese Automotive Industry: A Qualitative Research Based on Dual Managerial Perceptions. *International Journal of Management and Business Research*, 3(2), 89-105.
- Dyer, J., & Nobeoka, K. (2002). Creating and managing a high performance knowledge-sharing network: the Toyota case. *Strategic Management Journal* 21(3): 345-367. doi: 10.1002/(SICI)1097-0266(200003)21:3<345::AID-SMJ96>3.0.CO;2-N
- Easterby-Smith, M. and Lyles, M. A. (2012) *The Evolving Field of Organizational Learning and Knowledge Management*, in *Handbook of Organizational Learning and Knowledge Management* (eds M. Easterby-Smith and M. A. Lyles), John Wiley & Sons, Inc., Hoboken, NJ, USA. doi: 10.1002/9781119207245.ch1
- Eckl, V. C. (2012). Creating an Interactive-Recursive Model of Knowledge Transfer. *Working Paper submitted at Danish Research Unit for Industrial Dynamics, Summer 2012 Conference*. CBS, Copenhagen, Denmark.
- European Research Area and Innovation Committee (2014). *ERAC Peer Review of the Spanish Research and Innovation System. Final report, August 2014*. Retrieved from: [https://ec.europa.eu/research/innovation-union/pdf/erac/es\\_peer\\_review\\_report\\_2014.pdf](https://ec.europa.eu/research/innovation-union/pdf/erac/es_peer_review_report_2014.pdf)
- Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Research policy*, 29(2), 109-123. doi:10.1016/S0048-7333(99)00055-4
- Fang, S. C., Yang, C. W., & Hsu, W. Y. (2013). Inter-organizational knowledge transfer: the perspective of knowledge governance. *Journal of Knowledge Management*, 17(6), 943-957. doi: <http://dx.doi.org/10.1108/JKM-04-2013-0138>
- Flick, U. (2014). *An introduction to qualitative research*. Sage
- Graham P.J. (2008, January). *Knowledge Transfer in Theory and Practice: A Guide to the Literature*. Social Research Unit, Department of Sociology, University of Saskatchewan, Saskatoon, Canada. Retrieved from: [http://www.academia.edu/1962622/Knowledge\\_Transfer\\_in\\_Theory\\_and\\_Practice\\_A\\_Guide\\_to\\_the\\_Literature](http://www.academia.edu/1962622/Knowledge_Transfer_in_Theory_and_Practice_A_Guide_to_the_Literature)
- Grant, R. M. (2002). The knowledge-based view of the firm. In Choo, C. W., & Bontis, N. (2002). *The strategic management of intellectual capital and organizational knowledge*. (pp. 133-148) Oxford University Press, 2002 - Business & Economics.
- Hendriks, J. (2012). Technology transfer in human vaccinology: a retrospective review on public sector contributions in a privatizing science field. *Vaccine*, 30(44), 6230-6240. doi:10.1016/j.vaccine.2012.07.087
- Hoopes, D. G., & Postrel, S. (1999). Shared knowledge, "glitches," and product development performance. *Strategic Management Journal*, 20(9), 837-865. doi: 10.1002/(SICI)1097-0266(199909)20:9<837::AID-SMJ54>3.0.CO;2-I
- Wan, J., Liu, Q., Li, D., & Xu, H. (2010). Research on Knowledge Transfer Influencing Factors in Software Process Improvement. *Journal of Software Engineering and Applications*, 3(02), 134-140. doi:10.4236/jsea.2010.32017
- Kitagawa, F., & Lightowler, C. (2013). Knowledge exchange: A comparison of policies, strategies, and funding incentives in English and Scottish higher education. *Research Evaluation*, 22(1), 1-14. doi: 10.1093/reseval/rvs035

- Kumar, J. A., & Ganesh, L. S. (2009). Research on knowledge transfer in organizations: a morphology. *Journal of Knowledge Management*, 13(4), 161-174. doi: <http://dx.doi.org/10.1108/13673270910971905>
- Mohammed, Y., Sax, U., Dickmann, F., Lippert, J., Solodenko, J., Voigt, G., & Rienhoff, O. (2010). *On Transferring the Grid Technology to the Biomedical Community. Studies in Health Technology Information*, Vol. 159, 28-39. doi: 10.3233/978-1-60750-583-9-28
- Patton, M. Q. (2003). *Qualitative evaluation checklist. Evaluation Checklists Project. Evaluation*. Checklists Project. Retrieved from: [http://dmeformpeace.org/sites/default/files/Patton\\_Qualitative%20Evaluation%20Checklist.pdf](http://dmeformpeace.org/sites/default/files/Patton_Qualitative%20Evaluation%20Checklist.pdf)
- Patton, M. Q. (2005). *Qualitative research*. Encyclopedia of Statistics in Behavioral Science. doi: 10.1002/0470013192.bsa514
- Paulin, D. & Suneson, K. (2012). Knowledge transfer, knowledge sharing and knowledge barriers-Three blurry terms in KM. *The Electronic Journal of Knowledge Management*, 10(1), 81-91.
- Ramakrishnan, S. (2004). An industrial ecology framework to assist transferring environmental technologies. *International Journal of Technology Transfer and Commercialisation*, 3(2), 147-165. doi: 10.1504/IJTTC.2004.004606
- Roulston, K. (2013). Interviews in Qualitative Research. *The Encyclopedia of Applied Linguistics*. DOI: 10.1002/9781405198431.wbeal0572
- Sebastian, J. (2008). The knowledge transfer in the cooperation for development. *Arbor-Ciencia Pensamiento y Cultura*, 184(732), 719-728. doi: 10.3989/arbor.2008.i732.217
- Spencer, J. W. (2003). Firms' knowledge sharing strategies in the global innovation system: empirical evidence from the flat panel display industry. *Strategic Management Journal*, 24(3), 217-233. DOI: 10.1002/smj.290

# Agrobiodiversity Products by SWOT Analysis as an Analysis for Strategic Innovation

Amanda Valverde <sup>1</sup>, Sandra Magalhães-Fraga <sup>2</sup>, Jorge Magalhães <sup>\*1</sup>, Wanise Barroso <sup>1</sup>

**Abstract:** The paper aimed to demonstrate the potential of agro-biodiversity products derived from medicinal plants of the family farmers in Profito network (specific program of the Brazilian government). Method used was scenarios analysis of the knowledge. Literature review it was in the scientific database. According to the new “green wave” created by contemporary society aiming a better health and quality of life by population, it led to the depredation of medicinal species due to the acceleration of global trade demand. Thus, was constructed a SWOT analysis to support managers in strategic planning through of the potential agro-biodiversity products. It shows the appreciation of environmentally conscious products, economically sustainable and the creation of new public policies that ensure and valuation to the rescue, conservation and sustainable use of biodiversity since they are essential for building this niche market.

**Keywords:** agrobiodiversity; technological innovation; SWOT; knowledge translation; knowledge management.

Submitted: June 2nd 2015 / Approved: December 2nd 2015

## Introduction

According Organization for Economic Co-operation and Development (OECD) innovation is the implementation of a product or service, process or new method significantly improved. Innovative activities involve scientific steps, technological, organizational, financial and commercial (OCDE, 1997). That is, the innovation can arise through a range of variants in the development of new products, services, methods, partners, marketing, and/or during the search for improved products and processes that qualify.

Technological innovation process is closely linked to the history of science, the transformation of knowledge into innovations that affect society, creating organizational competitive advantages at different levels. The context of innovation was introduced by the economist Schumpeter in 1942 describing it as creative destruction by reason of considerable imbalance in the economy (Machado, 2012).

Trend to what is termed as innovation economy emerged after World War II. In the Brazilian economy in the 90s the landmark for opening of the market boosted the internationalization. In this sense, innovation was recognized by acquisition competitive advantages (Machado, 2012).

There has been a growing effort by scholars to establish and implement tools able to investigate innovative strategies to originate competitive advantages such as Porter Forces, Critical Success Factors, SWOT analysis, Balanced Scorecard, Benchmarking and Data Mining so on.

Although there are huge literature on innovation they are still incomplete works that contribute to the green economy based on biodiversity (Villas Bôas, 2013). This fact can be considered as of great impor-

tance in order to be exploited as a source of competitive advantages for biodiversity drugs and its derivatives, primarily in Brazil.

Brazil is shelter to the greatest diversity on the planet. It has more than 20% of the total number of species on earth and it is included among the 17 mega-diverse countries. Biodiversity occupies about 40% of Brazil's GDP (in 1997 estimated at US \$ 866 billion). The biodiversity products account for 31% of Brazilian exports. In addition, much of the population makes use of medicinal plants as therapeutic health practices. This way the value of biodiversity is incalculable given that the conservation and sustainable use are essential for humanity (MMA, 2014).

The term agricultural biodiversity was not explicitly mentioned in the text of the Convention on Biological Diversity (CBD). However, it was more defined by Decision V / 5 of the 5th Conference of the Parties to the Convention, as “[...] a broad term that includes all components of biodiversity that are relevant to agriculture and food; It includes all components of biodiversity that constitute the agro-ecosystems: the variability of animals, plants and micro-organisms, the genetic level of species and ecosystems needed to sustain the key functions of agro-ecosystems and their structures and processes” (CDB, 2014).

Agrobiodiversity combines the three levels of complexity related to biodiversity: farming systems, species, varieties, breeds and cultural diversity. In addition to human interventions which are fundamental to the understanding of agricultural biodiversity, i.e., different management practices of agro-ecosystems, knowledge and traditional agricultural knowledge related with adhibition (Machado, Santili & Magalhães, 2008). In this context of combinations there are components of high interest for sustainable environmental development focusing on rural and local communities, “quilombolas” (this term are the current inhabitants of rural black communities founded by

<sup>1</sup> Department of Post-graduation in Management, Research and Development in the Pharmaceutical Industry. Oswaldo Cruz Foundation/FIOCRUZ/Farmanguinhos. Brazil.

<sup>2</sup> Ecology, Conservation and Management of Silvestre Life in Federal University of Minas Gerais. Oswaldo Cruz. Brazil.

\*Corresponding author: jorgemagalhaes@far.fiocruz.br





escaped African slaves who live mostly on subsistence farming on land donated, purchased or occupied for a long time) and indigenous peoples, representing accumulation of knowledge transmitted from generation to generation.

Studies conducted by the Ministry of Environment on Agricultural Biodiversity and Cultural Diversity, report that in addition to the medicinal and aromatic plants and native seeds there are other forms of use of agricultural biodiversity with great importance to the everyday reality of family farming and traditional communities. This things representing important strategies to generate income and social inclusion among them the agroforestry System (AFS) which support several initiatives scattered throughout the country (MMA, 2014).

Agrobiodiversity is part of the Government' Multiannual Plan (PPA - Brazilian term) for discussions and definitions for the period 2004 to 2007. The reasons taken into Political consideration were: recognition by government of the mainstream communities, family farmers and indigenous peoples, need of government support for strengthening the organization, knowledge and support of the community experiences of conservation and use of agricultural biodiversity. Added to contribute rescuing of the dignity of farmers as active agents of the process of domestication and conservation of plants and animals. When the agro-biodiversity is institutionalized into government, it becomes a priority for the Secretary of Biodiversity and Forests as well as a cross-cutting tool and partnerships with other ministries (MMA, 2014).

In 2003, there were actions and social movements conducted by the population. In this sense, these first actions undertaken gave way for dialogue with social movements and non-governmental organizations linked to agriculture families and local communities. On the other hand, following the guidelines of the MMA, priority was given to the exercise of intersections among federal agencies that operate together with the Ministry of Health and National Health Surveillance Agency (ANVISA - Brazilian term) on issues related to medicinal plants, use of medicines homemade herbal and developing models of clusters of medicinal plants and herbal medicines (MMA, 2014).

Another complementary strategy carried out by federal agencies was the technical and financial support to participate in events aiming the rescue, sustainable use, conservation and enhancement of agricultural biodiversity throughout the national territory such as the First National Meeting on Agricultural Biodiversity and Cultural diversity, held in Brasilia on 28 and 29 November 2003. Furthermore, the growing demands and limitations in financial resources it became necessary a strategic joint covering fundraising and support for project rescue, recovery and sustainable use of agricultural biodiversity. So, it was created the Dissemination Centers of Agricultural Biodiversity Stewardship (CIMAs). These are intended to consolidate activities in five thematic areas among them medicinal plants and herbal products and agroforestry (MMA, 2014).

The National Agricultural Biodiversity Programme came at the time when the rights of family farmers, traditional communities and indig-

enous people to the free use of biodiversity has been recognized and regulated by the international and national agencies. This act has innovative character, it differs in the way it was designed (participation of society from the beginning - especially the National Articulation of Agroecology (ANA - Brazilian term). In June 2006, the Conservation on Biological Diversity (CDB - Brazilian term) and the Treaty on Plant Genetic Resources for Food and Agriculture of the United Nations - FAO (TIRFAA) recognized practices and innovations of these populations as subjects of innovation and breeding of wild biological resources and component cultivated biodiversity, agro-biodiversity during II National Meeting of Agroecology (IIENA - Brazilian term). After that the National Articulation of Agroecology (ANA) through Working Group on Biodiversity together with the Ministry the Environment (MMA - Brazilian term) and other ministries struggled to build the National Agricultural Biodiversity Programme also called Conservation Program, Management and Sustainable Use of Agricultural Biodiversity (FAO, 2009).

According to the Non-Government "Terra de Direitos" - NGO (2011), via the Assessment and Monitoring Bulletin of the National Agricultural Biodiversity Programme, there are need for public policies that promote sustainable agriculture systems as a tool for the promotion of agro-ecological practices as traditional way conservation of biodiversity. The program's actions aiming strengthen existing experiences of use and conservation of agricultural biodiversity, encourage the creation of new experiences and their networking and the establishment of guidelines aimed at influencing public policies and legal frameworks in the subject (Non-Government Organization - NGO "Terra de Direitos", 2011).

Thus, when it uses the term "agro-biodiversity products" is intended to encompass all those with specific qualities linked rural area such as colonial products, traditional, artisanal, family farming, land, biodiversity and socio-biodiversity. It is worth noting issues of rescue, sustainable use, conservation and enhancement of agricultural biodiversity.

As an example of agro-biodiversity products there are sachets of dried herbs intended for use in teas, soft fresh herbs sold in street markets, liquid soaps derived from medicinal plants, jellies and sweet compote among other products developed by family farmers in the West Zone of Rio de Janeiro - Brazil.

Therefore, this study aimed to demonstrate the potential of the products of agricultural biodiversity through a tool for scenario analysis of knowledge known as SWOT analysis in order to subsidize decision makers in strategic planning.

## Method

This work originated from the experience of innovation management products of agricultural biodiversity derived from medicinal plants of the family farmers of western Rio de Janeiro area belonging to network PROFITO (Brazilian term referring to the Profito network wich established in July 2006 aiming to promote the implementation of production, processing and marketing of medicinal

plants in the Pedra Branca Massif agricultural communities - Rio de Janeiro / Brazil as an alternative to social development and environmental sustainability. This network belongs at Management Unit project Biodiversity and Health of Farmanguinhos (NGBS – Brazilian term) – FIOCRUZ. More information in [http://www.far.fiocruz.br/farmanguinhos/index.php?option=com\\_content&view=article&id=283:profito-se-reune-com-empresa-florestal-e-agricola&catid=53:outras-noticias&Itemid=94](http://www.far.fiocruz.br/farmanguinhos/index.php?option=com_content&view=article&id=283:profito-se-reune-com-empresa-florestal-e-agricola&catid=53:outras-noticias&Itemid=94) ).

Data analysis on the market of medicinal plants and products of agricultural biodiversity were previously identified through the survey of scientific articles indexed in databases such as Scielo, PubMed, SCOPUS etc. Similarly, with respect to the market, official databases such as the Ministry of Health of Brazil (MS - Brazilian term), ANVISA and IMS Health. The terms used for research were “biodiversity”, “agricultural biodiversity”, “Biodiversity drugs”, “herbal medicines” and “agribusiness”.

After obtaining the data, it analyzed and highlighted major themes and sub-themes of agro-biodiversity, it was drawn a parallel with those derived from medicinal plants obtained of the family farmers of the West Zone of Rio de Janeiro whose database is available from PROFITO network.

In this sense, it was used the SWOT tool for better visualization of the results in order to better identify the FORCES (S), Weaknesses (W) Opportunities (O) and Threats (T) for products of Brazilian agro-biodiversity. The SWOT method can be seen in Figure 1.

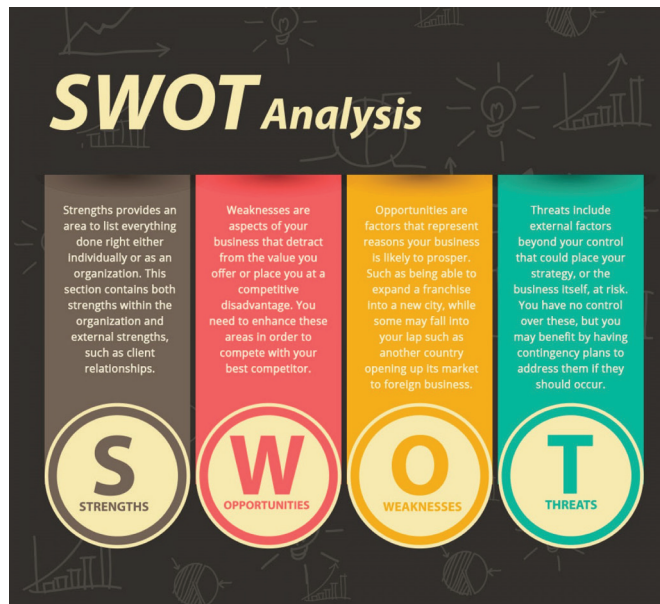


Figure 1: SWOT analysis. Source: Visual, 2014.

The SWOT analysis comes from the English acronym Strengths, Weaknesses, Opportunities and Threats. This technique was developed by Albert Humphrey (1960s) and is intended to be a tool used to make scenario analyzes or environment. It is consolidated in manage-

ment and strategic planning of organizations due to practicality in use. This analysis is used to the management of an activity of a company because the results of this analysis, it can check not only the status of organization but also its strategic position in the environment which it operates.

## Results and Discuss

### The herbal market

In the 21st century, the world began to observe the environmental dilemma in a universal dimension. Quality of life has become a public health issue and consequently the natural products have become a modern question as well as a symbol of a new era in the world consumption (Gomes, 2009).

Brazilian consumers have become more demanding and more aware. So, the search for new products with much better quality and lower cost become matched its profile, in view of that the current buyers have to take an active role in the market. The cause of this change of use and consumption is closely linked to the volume of information available from the internet and television besides the traditional “word of mouth” (Carlucci, 2014).

The associated values and concepts that underlie the consumer’s mind health food consolidate in health and quality of life. Since then the business in a global economy started to offer not only products but the responsibility for the environment and the establishment of “green policies” as a means of competitive advantage (Gomes, 2009).

According to surveys conducted by Gesellschaft für Konsumforschung (GfK) there are eight main factors that influence consumers in purchasing decisions, such as: 78% prior experience with the brand/retail; 70% samples/demonstration of products; 66% information on the shelves; 64% of general shopping sites; 63% of consumer reviews sites; 63% price comparison; 59% of the brand site and 57% opinion known (GfK, 2014).

The market for natural products is considered attractive because it has roots in the worldwide movement of contemporary society by the pursuit and aspiration for more and better quality of life, which is basically related to two major themes: health and environment (Gomes, 2009).

Consumption trends of these products leveraged the creation of niche markets settling mainly in urban centers in specialized shops. However, lately, it has gained a new dimension in large supermarket chains becoming a major segment in retail (Gomes, 2009).

Worldwide are sold more than 400 tons of medicinal and aromatic plants involving possible 53,000 species of plants (Schippman, Leaman & Cunningham, 2002). According to the country in analysis, up to 90% of such materials are harvested unsustainably. The natural habitat is even more pressing when the indiscriminate collection occurs or when the global commercial demand accelerates (Rosenberg, 2014). There are over 28,000 plants to the Convention on International Trade in Endangered Species Extinction (Cordeli, 2011).

Data from WHO Strategy on Traditional Medicine (2002-2005), shows that the use of traditional medicine is quite significant and is widespread throughout the world. Facts that support the strategic importance of supporting the conscious and sustainable use of medicinal plants aiming at the growth of this segment in the market (WHO, 2002).

Considering this growth, there are factors driving the market for natural products such as: consumers looking for products with favorable qualities to the environment, “chemical-free”; proliferation of specialized markets in raw materials focusing on the supply and quality control; shift the focus of trade, natural products are becoming final product, ready for use; growing interest in health and wellness and a greater amount of natural ingredients available.

Large companies seek innovation in their products to accompany the current demand in 21st century. An important feature for the product to be a differential in the market is to think of a proposal to reduce its chemical constituents, thinking about product life time and their disposal on the environment. Thus, they are seeking technologies from organic raw materials to meet the environmental problems and their causes reaching the choice of manufacturing materials as is technically possible and ecologically necessary. Nevertheless, Brazilian Government has promoted actions in recent decades for the Research, Development and Innovation (R,D&I) for medicinal products such as the Law of Generic Drugs, Innovation Law, Law of Good, Greater Brazil Plan, Profarma program of the National Bank for Economic and Social Development (BNDES) etc. (Magalhaes, Antunes & Boechat, 2012). It is worth mentioning investment policies also in the Brazilian health such as updating of the list of drugs used in the Unified Health System (SUS - Brazilian term) of the Brazil whose MS use this policy for dissemination strategy and so guides the Partnership for Production Development (PDP - Brazilian term) in Brazilian territory with public and private industries (Cartaxo, Antunes & Magalhães, 2014).

The market has developed products with more elaborate packaging, seeking innovation in biotechnology and nanotechnology (Alencar et al., 2012). In the cosmetics area there is a demand from companies for new excipients for the development of new formulations with different sensorial with green technologies to the reduce impacts on the environment. In this sense, to reduce using plastics and polymers to manufacture more functional packaging and so to be better preservation product and better performance in its application as well as biodegradable packaging.

In addition to the appeal of sustainability a good product is elected by the composition of raw materials so it is important concern for its disposal respecting the environment but must meet also the nature and understanding of the mechanism of action. Therefore, it is essential to understand the action of responsibility on the product and its application.

This new “green wave” is not restricted to the food industry. The cosmetics industry has invested heavily in product research on biodiversity assets and now occupy the same space on the shelves that products “unnatural” (Gomes, 2009).

According Yamada et al. (2004), consumers generally cannot tell what are the main differences between a natural cosmetics or organic, sustainable or to synthetic chemical. According to authors lack professional information transfer customer reliably.

Studies show that 84% of the American population is concerned with the current situation of nature and that this concern interferes with their buying habits; 54% read the packaging to verify that the product is environmentally friendly and 57% want to acquire products and packaging made from recycled material (SIMPOI, 2014).

This behavior is also being explored by Brazilians, although Brazil is a developing country, and the purchasing power does not always accompany the desire to purchase environmentally friendly products, which usually have a higher price.

In 2012, research conducted by GFK consultancy by magazine “Consumidor Moderno” quoted in SIMPOI annals (2014) shows that 27% of respondents indicated that give preference to brands/companies who defend any cause (environmental and/or social) even if the product price is higher than similar and 57% say they give preference to those brands/companies since the price is similar to other.

In the early 21st century the market has released the biocosmetics also known as phytocosmetic. Cosmetics considered “environmentally friendly” must necessarily be of natural origin and may be disseminated by organic or agroecological culture. Also, it made with ingredients that follow quality standards and sustainability established by certifying agencies able to guarantee consumers the quality of products purchased.

Brazil is favored in this segment due to its biodiversity as ingredients manager highly demanded by the global industry. However, is not large share in the market which is dominated by European and American companies. According to a report published in the Folha de São Paulo (News Magazine), in March 2014 says: “the segment of organic cosmetics, although they represent only 2% of the total market, already generates nearly US \$ 9 billion worldwide” (Freitas, 2014).

According to the Brazilian Association of Toiletries, Perfumes and Cosmetics, the Brazilian industry had an average growth of 10% annually over the last 18 years, going from a turnover “Ex-Factory”, net of sales taxes, US \$ 2 billion in 1996 to US \$ 17 billion in 2013. This fact, currently occupying the third position on the world market for personal hygiene, perfumery and cosmetics (ABIHPEC, 2014).

It is hoped that with this new concept of natural, sustainable product, agro-biodiversity products can win new segments and valuation retailers and specific markets. There is plenty of room to be exploited by small businesses, since large companies live the challenge to achieve a high volume of consumers to justify the investment. Thus, it is necessary to seek a new approach to innovation in health care, with improved access in all aspects of industrial health complex economic (Costa, Gadelha & Madonado, 2012).



## A Strategic Vision for SWOT Analysis

Given the fact above mentioned and by selecting the data collected by the methodology it was possible to build the SWOT matrix which enabled the definition of a strategy for R,D&I products derived from medicinal plants originating from agricultural biodiversity (Figure 2).



Figure 2: SWOT analysis of agro-biodiversity products derived from medicinal plants.

Source: Created by the authors, 2015.

Considering the scenarios of agro-biodiversity products by SWOT analysis above, it can highlight:

### a) Strengths:

- The products of agricultural biodiversity, value empirical knowledge and local farmers, considering that based on the participatory construction and the principles of popular education. Likewise, they make use friendly farming techniques, which provide a medicinal plant cultivation environmentally conscious, highly productive and economically sustainable. The production takes place in agro-ecosystems that provide greater integrity and sustainability of land resources (Gliessmasn, 2001).
- The use of agro-ecological practices for cultivation of medicinal plants does not require large areas, which makes the low cost of production, but requires hand labor intensive and careful management. Besides enabling a wide biodiversity within the same system, which is favored in Brazil be considered extremely diverse country.

### b) Weaknesses:

- There is a need for specialization of labor, work facing the demands of cultivation, propagation, collection and processing in the processing of medicinal plants to guarantee a final product with quality.

- There are projects that work helping farmers in running training courses. However not all producers of medicinal plants have access to these networks, and require hiring labor, skilled labor, rising costs in the marketing of products, and there is not always available, which generates an embezzlement in production.
- So that the product meets the quality standards and can safely reach the consumer follow-up is needed since the botanical identification to the development of the final product.
- Improper botanical control coupled with low productivity levels affect sustainability. Besides being necessary investments in machinery for the processing of medicinal plants, such as greenhouses and nurseries for seedling production, specific dryers and grinders for medicinal plants, as well as scales and sealing.

### c) Threats:

- Despite the diversity of products be considered a strength, the medicinal plants duty cycle is varied according to species, so there is no all species for marketing throughout the entire year.
- The producers of medicinal plants could act as vegetable raw material suppliers to industries, municipalities and / or large enterprises. But this mechanism is not considered good way, because the product does not have value and is a market with great middlemen who do not allow the entry of small producers, as is the case of family farmers. Family farming is characterized by production in diversity, so the direct suppliers of large companies and industries seeking resources with many small producers, farmers, for a lower price and earn great proportions in this market.
- In addition to these factors there is a regulation of these products demand, to ensure the sale in street markets and enable the introduction in pharmacies, health food stores and supermarket chains.
- There is an urgent need for a dialogue between farmers, research and extension institutions and standard-setting and regulatory agencies on problems and demands related to the processing and marketing of products from agricultural biodiversity, it is essential to rural development debates today. That's because to stay in rural are needed alternative sources of income for families and at the same time, there is a need to meet the requirements of environmental and health legislation by farmers, who now need this legislation to access new and promising markets.
- In the spaces of dialogue on agro-biodiversity products, especially with regard to the processing and marketing of products coming from family farming issues are discussed and the need for specific legislation for these farmers and their production processes, as the current standard does not They differentiate them from large industries and provides several interpretations. In this sense the debate on the quality always is present, from different perceptions, some extolling the health aspects such as product safety and other artisan preparation mode. The origin of the raw materials used in processing sites is another issue that shows the conflict between the laws that work on family farms.

### a) Opportunities:

- Agrobiodiversity products reach a large portion of consumers for marketing in street markets, allowing a link between farmers, socializing knowledge, and bringing consumers the products, enabling explore new markets.
- As identified by Almeida & Albuquerque (2002), markets are open knowledge systems, because the information is often exchanged between the sellers and is usual to find among them a large consensus plants to treat a certain condition. The exchange of products is also common, whereas a seller may consult each other when a client does not find the desired product in its own stock.
- Well as discussed earlier, the market of medicinal plants is constantly growing, by more demanding consumers, seeking alternatives, environmentally sustainable and natural. Favoring new market niches facing the solidarity economy, which act directly in relation to traditional know-how and craftsmanship.

### Final Considerations

Organizations should incorporate in all its activities the concept of innovation in order to remain in constant renewal, leadership, updating and searching this area to better management of costs and investments. One of the tools that assist the process of constant strategic analysis of practical, is the SWOT analysis. The object of this work, this proved effective Tools, pointing more opportunities and strengths for agricultural biodiversity than the Weaknesses and Threats.

Agrobiodiversity products reach a range of Consumers Attracted by better quality of life, seeking sustainability and value the tacit-explicit knowledge. These products are marketed through the fairs Primarily Aimed at solidarity economy. Thus Provides closer links between producers and Consumers.

### Acknowledgements

The authors thank the master's program of the Institute of Technology in Drugs (Farmanguinhos/FIOCRUZ) and the National Counsel of Technological and Scientific Development (National Council for Scientific and Technological Development - Brazilian term).

### References

ABIHPEC (2014). Panorama of the personal care industry, perfumery and cosmetics. Retrieved on 20/03/2015 from

<http://www.abihpec.org.br/category/publicacoes/panorama-do-setor/>

Alencar, M.S.M., Silva, C.H., Nunes, J., Mendes, F.M.L. & Antunes, A. M. S. (2012). Trends in Nanotechnology Patents Applied to the Health Sector. Recent patents in nanotechnology, 6, 29-43.

Almeida, C.F.C.B.R. & Albuquerque, U.P. (2002). Use and conservation of medicinal plants and animals in the state of Pernambuco (northeastern Brazil): a case study. *InterCiência*, 27, 276-285.

Carlucci, C. (2014, July 31). Changed the market or the consumer. Retrieved on 15/04/2015 from [http://www.diariodocomercio.com.br/noticia.php?tit=mudou\\_o\\_mercado\\_ou\\_o\\_consumidor&id=138885](http://www.diariodocomercio.com.br/noticia.php?tit=mudou_o_mercado_ou_o_consumidor&id=138885)

Cartaxo, R. J. A., Antunes, A. M. S., Magalhães, J.L. (2014). Drug production and Drugs in Brazil: a proposed methodology for prioritization of Strategic listing on SUS Scope. *Revista Eletrônica de Comunicação, Informação & Inovação em Saúde*, 8, 478-495.

CDB (2014). Agricultural biological diversity: review of phase I of the programme of work and adoption of a multi-year work programme. Retrieved on 05/04/2015 from <http://www.cbd.int/decision/cop/?id=7147>.

Cordell, G.A. (2011). Sustainable Medicines and Global Health Care. *Planta Med*, 77, 1129-1138.

Costa, L.S., Gadelha, C.A.G., Maldonado, E.J. (2012). Health care innovation from a territorial perspective: a call for a new approach. *Rev. Saude Pública*, 46(1), 59-68.

FAO (2009). The United Nations Food and Agriculture. Retrieved on 08/05/2015 from [https://www.fao.org.br/cr\\_eventospar\\_tirfaa.asp](https://www.fao.org.br/cr_eventospar_tirfaa.asp).

Freitas, T. (2014, March 23). No rule, the country is supporting organic cosmetics. Retrieved on 03/05/2015 from <http://www1.folha.uol.com.br/fsp/mercado/157747-sem-norma-pais-e-coadjuvante-em-cosmeticos-organicos.shtml>.

GFK (2014). Retrieved on 03/05/2015 from <http://www.gfk.com.br/news-and-events/news/paginas/mudou-o-mercado-ou-o-consumidor.aspx>.

Gliessmas, S.R. (2001). Agroecology: ecological processes in sustainable agriculture. Editora da Universidade (2<sup>nd</sup> ed.). Porto Alegre. UFRGS.

Gomes, A.N. (2009). The new consumers of natural products: Consuming concepts much more than products. 3<sup>rd</sup> Encontro ESPM de Comunicação e Marketing, 1-11.

IMS HEALTH. IMS Institute for Healthcare Informatics, iThe Global Use of Medicines: outlook through 2016, 2012.

Machado, M.V.C. (2012). Projects aimed at Market: analysis in an information technology APL in the metropolitan region of Belo Horizonte. Dissertation (Professional Master) - Fundação Pedro Leopoldo.

Machado, A.T., Santili, J. & Magalhães, R. (2008). The agrobiodiversity in agroecological approach: conceptual and legal implications. *Embrapa Informação Tecnológica*. Brasília, DF. Discussion paper 34.

Magalhães, J.L., Antunes, A.M.S. & Boechat, N. (2012) Technological Trends in the Pharmaceutical Industry: the matter of neglected tropical diseases - An overview of the Research, Development & Innovation in Brazil. Synergia Editora.



MMA (2014). Agrobiodiversity. Retrieved on 08/05/2015 from <http://www.mma.gov.br/biodiversidade/conserva%C3%A7%C3%A3o-e-promo%C3%A7%C3%A3o-do-uso-da-diversidade-gen%C3%A9tica/agrobiodiversidade>.

MMA (2014). Brazilian Biodiversity. Retrieved on 05/04/2015 from <http://www.mma.gov.br/biodiversidade/biodiversidade-brasileira>.

Non-Governmental Organization ñ NGO ìTERRA DE DIREITOS (2011). Evaluation and monitoring report of the National Agricultural Biodiversity Program. <http://terradedireitos.org.br/>. Retrieved on 05/04/2015 from <http://terradedireitos.org.br/wp-content/uploads/2011/04/Programa-Nacional-de-Conserva%C3%A7%C3%A3o-da-Agrobiodiversidade-INTERNET-1.pdf>.

Rosenberg, M. (2014). Life expectancy. Retrieved on 03/05/2015 from <http://geography.about.com/od/populationgeography/a/lifeexpectancy.htm>.

Schippmann, U., Leaman, D.J. & Cunningham, A.B. (2002). Impact of Cultivation and Gathering of Medicinal Plants on Biodiversity: Global Trends and Issues. Biodiversity and the Ecosystem Approach in Agriculture, Forestry and Fisheries. Satellite event on the occasion of the Ninth Regular Session of the Commission on Genetic Resources

for Food and Agriculture. Inter-Departmental Working Group on Biological Diversity for Food and Agriculture. Rome. FAO. Retrieved on 10/05/2015 from <ftp://ftp.fao.org/docrep/fao/005/aa010e/aa010e00.pdf>.

SIMPOI (2014). Application range ECCB: behavior of consumers of green products. Retrieved on 05/04/2015 from [http://www.simpoi.fgv.br/arquivo/2014/artigos/E2014\\_T00208\\_PCN17534.pdf](http://www.simpoi.fgv.br/arquivo/2014/artigos/E2014_T00208_PCN17534.pdf).

Villas Búas, G.K. (2013). Innovation Biodiversity drugs: a necessary adaptation (or useful) in public policy. Thesis (Ph.D.) - National School of Public Health Sergio Arouca, Rio de Janeiro.

Visual (2014). Swot Analysis. Retrieved on 08/05/2015 from <http://visual.ly/swot-analysis>.

WHO (2002). WHO strategy on traditional medicine from 2005 to 2005. World Health Organization Geneva. Retrieved on 10/05/2015 from [http://whqlibdoc.who.int/hq/2002/WHO\\_EDM\\_TRM\\_2002.1\\_spa.pdf](http://whqlibdoc.who.int/hq/2002/WHO_EDM_TRM_2002.1_spa.pdf).

Yamada, D.A.S., Lima, L.R., Santos, S.N., Itani, A.F., Dias, L.C.V. & Higuchi, C.T. (2013). Critical discussion of the organic law applied to sustainable cosmetics and scientific research in the practice of consumption. *Revista Interfaces*. 3(8), 3-20.

# Feature Fatigue, IT Fashion and IT Consumerization - Is There a Relationship?

Luiz Antonio Slongo<sup>1</sup>, Mery Blanck<sup>2</sup>, Rafael Alfonso Brinkhues<sup>\*3</sup>, Rafael Mello Oliveira<sup>4</sup>

**Abstract:** Based on the concepts of Feature Fatigue, IT Fashion and IT Consumerization, this paper aims to investigate the relationships between them answering two questions: (1) does the phenomenon of IT Fashion result in Feature Fatigue? (2) Will the concept of Feature Fatigue cause the same effect when looking from the point of view of the IT Consumerization in the corporate environment? The research addresses these questions through two techniques: a laddering and a survey. Albeit tenuously, the results provide evidence that consumption motivated by IT Fashion leads to Feature Fatigue. This study contributes to management research by attempting at the phenomenon described from a multidisciplinary perspective, also contributing to management practice, specifically for marketing managers trying to understand the experiences and expectations of consumers, and also for IT managers engaged in the design of governance policies regarding the use of personal devices by employees in this context.

**Keywords:** feature fatigue, IT fashion, IT consumerization.

Submitted: June 28th 2015 / Approved: December 6th 2015

## Introduction

Technological advances have enabled manufacturers to add many features to new products, especially their electronics and IT devices, at a relatively small cost per added feature. A consumers' purchase decision tends to the equipment with the largest number of features. The use experience, however, can be so complex that it leads to a so-called "Feature Fatigue" effect (Thompson *et al.*, 2005). Feature Fatigue could correspond to 50% of product returns in the USA (Surowiecki, 2007).

Additionally, the possibility to buy devices with a large number of features at a reduced incremental cost has contributed to an expansion of consumption of products that become rapidly obsolete. These are equipment, therefore, that will be considered outdated in a short timespan because of the new products launched with better or more features, triggering a phenomenon known as "IT Fashion".

On the other hand, a significant trend has been at work in the personal electronics market in the past ten years, affecting organizations in particular: the tendency of technology to spread from the user to commercial and public environments, called the "Consumerization of IT" (Shuster, 2011). The increase in processing power and resources of these devices (Sen, 2012), which enabled the expansion of available service functionalities in a single device, is especially important in this context (Chaka, 2012; Goul *et al.*, 2012).

Apart from the increasing interest they've awakened in academic research, these three research subjects are similar because of their connection to a new social context of technological impact. The consumer's need to frequently exchange his equipment for more modern products, which are launched at increasingly smaller time intervals, seems to be related to the ability of organizations to develop new features for their products, which makes consumers prefer them at the

time of purchase. However, according to Thompson *et al.* (2005), the complexity of use could be so significant that it leads to the Feature Fatigue effect.

For authors such as Cooper and Bess (2012), Ginovski (2012) and Sen (2012), individuals are no longer resigned to fact that they can have the best technology at their disposal in their private lives, but not in their professional life, especially as a function of two arguments: the maximization of productivity (Klinc *et al.*, 2008; Devine, 2012; Gupta, 2012) and the maintenance of a flexible lifestyle to work when and where they want (Bernnat *et al.*, 2010).

It is clear, therefore, that an investigation of the possible relations between these three subjects - IT Fashion and Feature Fatigue, and Consumerization of IT and Feature Fatigue - has become important from a scientific point of view in order to reevaluate the concept of Feature Fatigue from a contemporary perspective: a world where the supply and demand for technology have exploded and its customization keeps increasing. To investigate these relationships, this study will therefore try to answer the following questions: (1) Does the IT Fashion phenomenon have Feature Fatigue as consequence? (2) Does the Feature Fatigue concept still make sense when observed in the organizational context, i.e. from the point of view of the Consumerization of IT in a corporate environment?

In addition, this study seeks to contribute to the research in Business Administration. Because it analyzes the described phenomena from a multidisciplinary perspective, it also contributes to the management practice, specifically to marketing managers who are trying to understand the expectations and experiences of consumers, but also to IT managers who need to define governance policies concerning the use of personal equipment by employees and other collaborators in that context.

<sup>1</sup> School of Management Graduate Program, UFRGS (Federal University of Rio Grande do Sul).

<sup>2</sup> Industrial Engineering Graduate Program, UFRGS.

<sup>3</sup> IFRS (Federal Institute of Rio Grande do Sul)

<sup>4</sup> Management Department, UFPel (Federal University of Pelotas)

\*Corresponding author: rafael.brinkhues@caxis.ifrs.edu.br



## Theoretical Framework

The theoretical framework of the three guiding concepts of this work was investigated in order to characterize the idea of Feature Fatigue based on the proposition of Thompson *et al.* (2005), and especially, to import and translate the idea of IT Fashion to the individual's universe, given that the concept has its foundations in the field of organizations. We also sought to consolidate one concept of Consumerization of IT, which is a relatively recent phenomenon, although significant in so far that it proposes a new way for individuals and organizations to relate with the technology.

### Consumerization of IT

For the great majority of authors, Consumerization of IT means combining the corporate and personal use of technology devices or applications, causing what it is said to be "the growing influence that our technology experiences as consumers - both hardware and software - have on the technology that we expect to use at work" (Forrester, 2011, p. 2).

For Moschella *et al.* (2004) the defining aspect of Consumerization of IT is exactly the concept of dual use; Carter *et al.* (2011) identifies it as a potential change that has been occurring in the use of ICTs. Cazier and Hopkins (2011) associate it with the idea that it's the younger workers who are driving changes based on their own interactions with technology. Other authors summarize it as the tendency of consumer products and technologies to enter the corporate space (Cummings *et al.*, 2009; Prete *et al.*, 2011; Cohen, 2012; Gordon, 2012; Gupta, 2012). More specifically, Grasso and Convertino (2012) claim that it's a diffusion process of Web 2.0 tools from the consumer space to the organizational space. Lamy and McQuire (2010) connect both concepts by stating that Consumerization takes two forms: first there's the pressure exerted by employees to use their personal electronic devices on corporate networks in order to increase productivity, and second there is the increasing prevalence and adoption of social Web 2.0 tools such as *LinkedIn™*, *Facebook™* and *Twitter™* in a corporate context.

Although some see Consumerization of IT as a synonym for "Bring your own device" or "BYOD" (Love, 2012), others prefer to understand it as a more complex process that involves more than the corporate use of personal devices (Burger, 2012), relating directly to increased user control and interaction with IT resources (Sen, 2012). In fact for Chaka (2012) it's as a disruptive force that operates similarly in the IT ecosystem as the proliferation of PCs and the internet did decades ago. The BYOD phenomenon is only one method by which Consumerization can occur. Cooper and Bess (2012), on the other hand, extend the BYOD concept by stating that it's not only about devices, but also about secure, flexible and easy access to corporate information.

Using another nomenclature, Forrester refers to Consumerization as technological populism (Cameron, 2008), giving rise to the idea that it's not only a trend driven by technologically native workers, but also a movement in which the individual, and not organizations, drives

technological adoption (Katz *et al.*, 2008; Klinc *et al.*, 2008; Plummer *et al.*, 2008; Klinc *et al.*, 2009).

For some authors (Cooper and Bess, 2012; Ginovski, 2012; Sen, 2012), individuals are no longer resigned to fact that they can have the best technology at their disposal in their private lives, but not in their professional life, especially as a function of two arguments: the maximization of productivity (Klinc *et al.*, 2008; Devine, 2012; Gupta, 2012) and the maintenance of a flexible lifestyle to work when and where they want (Bernnat *et al.*, 2010). Increasingly, users of all levels wish to have the same access to business, entertainment, government and many other types of personal information as they have through tools like *Google™* (Burton *et al.*, 2006).

Synthesizing this reality, some authors defend that it's the blurring of boundaries between the personal and professional life which, in fact, led to Consumerization (UIowa, 2007; Klinc *et al.*, 2008; Gens *et al.*, 2011; Olden, 2011; Chaka, 2012; Cooper and Bess, 2012; Sen, 2012).

For Cameron *et al.* (2008) a combination of factors, such as the coming of age a technologically native work force, the ubiquity of broadband (Sen, 2012), and the proliferation of computational collaboration and socialization applications (Yourdon, 2011; Chaka, 2012; Sen, 2012), enhanced by a culture of collaboration (UIowa, 2007), has led to this phenomenon.

Gens *et al.* (2011) emphasize the aspect of mobility (Yourdon, 2011), in particular, as key-factor, given that the demand for smartphones, tablets and notebooks continues to accelerate to the detriment of traditional devices. The increase in processing power and resources of these devices (Sen, 2012), which enabled the expansion of available service functionalities in a single device, is especially important in this context of Consumerization. Especially when we take into account that many devices are designed exactly for integration (Chaka, 2012; Goul *et al.*, 2012). In addition to these factors, the large-scale adoption of the public cloud is also a facilitating agent of this process (Forrester, 2011; Prete *et al.*, 2011; Yourdon, 2011).

Gordon (2012) is more specific and argues that, similarly to the adoption of *Blackberry* devices over a decade ago, it was the messaging and calendar features, which today are web based, that led to the large-scale adoption of new devices, providing a friendly and fun experience for the consumer.

For Moschella *et al.* (2004) the consequences for organizations in the long term, include: radically reduced costs (Sen, 2012), improvement of features through a variety of new products, services and innovative applications, in addition to successive generations of users who are increasingly technologically savvy. Others add that competitiveness is increased (Forrester, 2011), business growth and productivity are accelerated through trust (Sen, 2012), the time required for the execution of tasks is reduced (Titus *et al.*, 2012) and that efficiency is increased (Wong, 2012). From a broader perspective, and bypassing the objective questions of productivity and ubiquity, Shehadeh (2008) associates Consumerization to the improvement of quality of life.

Carter *et al.* (2011) address the psychological aspect of Consumerization by stating that young people develop emotional bonds with the ICTs with which they interact daily; Gupta (2012) refers to this as an alternative way to conceptualize user needs, which he classifies in three dimensions that work interactively: (1) Nice to have; (2) Good to have; (3) Must have. These elements could suggest that there may be additional components aside from performance that determine the technological choice by the user, possibly guided by a collective belief that associates Consumerization to novelty, efficiency and vanguard, all elements that are present in the concept of IT Fashion.

### IT Fashion

Why do organizations adopt innovations? Most attempts to answer this question can be divided into two main schools of thought. On the one hand, the economic-rationalist perspective focuses on organizational performance and deals with the degree to which an organization achieves its goals, often measured in financial or economic terms (Wang, 2010). On the other hand, the institutional perspective emphasizes organizational legitimacy, which refers to a general perception or assumption that the actions of an organization are desirable or appropriate within the organization's environment of socially constructed norms, values and beliefs (Suchman, 1995).

The concept of Fashion fits into this innovation path. Just as with innovation, fashion is becoming a common phenomenon in information and communication technologies. Just like research and management, IT is in fact characterized by fashion trends. These waves of "IT Fashion" are relatively transient and represent an explosion of interest in specific topics by both researchers and professionals (Baskerville and Myers, 2009).

The concept of IT Fashion emerged based on the concept of "Management Fashion", which is a relatively transitory collective belief that an administrative technique is new, efficient, and at the forefront of management practice (Abrahamson, 1996). IT Fashion is a transitory collective belief that an information technology is new, efficient, and at the forefront of IT practice (Wang, 2010). Similarly, Benders *et al.* (2001) state that IT Fashion indicates the intense, but temporary production and consumption of an IT discourse.

New information technologies are emerging constantly and, as Wang (2010) found in his study, those organizations that follow IT Fashion are more admired, and although they do not always overcome their competitors, they do often have a better performance.

Fashion and fashion adoption build on each other, each supporting the other in a self-reinforcing cycle. When organizations start adopting a technology in an ongoing basis, a fashion trend starts to develop. However, it should be noted that when compared to Management Fashion, the high costs of transfer could make the practice of IT less prone to the inconstancies of fashion (Wang, 2010).

Taking the concept of *IT Fashion* from the domain of organizations and applying it to the scope of the individual, particularly in the context of the Consumerization of IT, we can observe that having a technologically advanced device represents not only a search for per-

formance, but also for legitimacy. Because they expect to increase their productivity at a bearable cost, people may therefore choose to purchase or use the most recent developments in IT as a way of creating value for themselves.

### Feature Fatigue

Feature Fatigue is reflected in the difficulty of the user to operate products with a large number of features (Thompson *et al.*, 2005). The increase in functions of devices is relatively cheap for factories, which can offer them for a small incremental price. At the time of purchase, the consumer considers such an offer more attractive and tends to prefer the products with the greatest number of features. Later, the challenges with which the consumer is faced to use the product make him stop using it, or even return it.

Based on this idea, two elements can be highlighted: capability and usability (Rust *et al.*, 2006). In the purchase decision, more weight is given to a product's capability. A negative user experience, however, may harm consumer satisfaction and his overall evaluation of the product.

In three studies the authors confirmed that an increase in the number of features has a positive effect on the perceived capability by consumers, but a negative effect on usability. Increased usefulness is therefore related to the balance in the amount of important features for each product (Thompson *et al.*, 2005). These results indicate that even market research may not eliminate the problem of Feature Fatigue. It is therefore important that consumer consultations take the dimension of usability into account to measure satisfaction in the long term (Thompson *et al.*, 2005).

Given that the majority of purchasers doesn't use all the features of their highly complex devices, companies should focus on producing simpler products. A good performance of the main features increases the usability at the expense of a large number of features (Thompson *et al.*, 2005).

Balancing the attractiveness at the time of sale because of the high number of features, with the usability and satisfaction in the long term can avoid the bigger problems associated with Feature Fatigue - product returns and a possible negative impact on the product's brand.

Effort has therefore been put into research to search for ways to mitigate this phenomenon, and a series of models for the assessment of Feature Fatigue have been developed to help manufacturers at the design stage of their projects (Li and McQuire, 2011; Li *et al.* 2012).

The solution to this problem can therefore not be reduced to the exclusion of features in technological devices, but lies instead in a better product design to reduce the effect of Feature Fatigue (Rahman and Rahman, 2009).

### Method

Two techniques were employed in order to meet the objectives of the study: the laddering methodology, which is a very useful tool to identify the benefits and personal values that are important to the



consumer (Saaka *et al.*, 2004) and a quantitative survey, which, according to Pinsonneault and Kraemer (1993), is a way to collect data and information about actions, opinions or peculiarities of a certain group of people who represent a target population through the use of a questionnaire.

The laddering method is a tool to study personal values as applied to marketing, reflecting a more profound relationship between the consumer and the products. It establishes the cognitive positions that consumers have in relation to products, enabling the marketer to develop strategies for the positioning of new products (Reynolds and Gutman, 1988). According to the instructions of Reynolds and Gutman the laddering method should be divided into two main stages: first, the collection of data, and second, the interpretation of data.

With regard to data collection, the laddering method starts with the completion of an in-depth personal interview based on a semi structured script. The interviews play an important role in the qualitative research because they give you access to the representations and descriptions of routines present in the lives of individuals, representing important sources of information. It is assumed that these interviews are an accurate portrayal of reality (Oliveira *et al.*, 2009). The advantage of in-depth interviews face to face is that there is no significant time delay between question and answer and, as such, the answer of the interviewee is more spontaneous, without an extended reflection (Opdenakker, 2006).

Twelve interviews were carried out following the guidelines for the laddering technique in order to meet the research objectives of investigating whether IT Fashion can lead to Feature Fatigue in the context of an individual. Since this was an exploratory study that used a quantitative approach, it presented a hierarchy of values that connect the *attributes* of the product sequentially with (A) the *consequences* of the use of the product, (C) personal *values* (V) of each consumer, forming an A-C-V chain. This is also known as a means-end chain, where the means are the products and the ends are the personal values (Saaka *et al.*, 2004).

After the data collection for this step of the method, the data was analyzed and interpreted to identify if there was any dynamic present between IT Fashion and Feature Fatigue from an individual perspective. The second stage of the research consisted of a survey that sought to compare the Feature Fatigue among consumers that used the equipment inside and outside the organizational environment. Before applying this technique, a pre-test was realized in order to refine the instrument. The survey was then applied to the students of three universities. The applied questionnaire was adapted from the study by Thompson *et al.* (2005), and divided into seven blocks, as follows:

- Block 1 - Features (three items)
- Block 2 - Usability (eight items)
- Block 3 - Expected utility of the product (six items)
- Block 4 - Skills (five items)
- Block 5 - Satisfaction (four items)
- Block 6 - Use of the phone (ten items)
- Block 7 - Qualifying variables (eight items)

The introduction of the questionnaire presents an image of six smartphones with a wide range of features. The respondent was invited to answer the questions considering one of these devices or their equivalent. In block 6 a question was included to divide the sample into respondents with and without experience in the use of these devices. This sample division enabled us to evaluate the expectation of use and satisfaction based on the premise of the study by Thompson *et al.* (2005) that expectations are greater than the satisfaction.

Finally, three questions were also included in block 6 to assess the incidence of the Consumerization of IT in the daily lives of respondents. Based on these questions it was possible to separate the sample and compare if Feature Fatigue also occurs in the organizational environment.

### Methodological Procedures of the Laddering:

The semi structured script of the laddering was composed of seventeen guiding questions. These were used to leverage answers that linked the attributes to the consequences and values. In some cases, the depth of the answer to any of the questions eliminated the need to ask other questions. Additional questions were included when necessary, on the other hand, according to the development of the interview.

To check the relationships between IT Fashion and Feature Fatigue, we explored the respondent's experience with his current smartphone and its features. During the interview the respondent was invited to reflect and compare the features of his current device, including their use, with his previous device. At the end of the interviews, four questions were asked to classify the respondents. Particular details of this procedure are as follows:

- twelve interviews were conducted (one was discarded because it didn't fit the target sample, leaving six men and five women).
- The interviews were held on November 27 and 28, 2012, in a study room of the library of the School of Administration of UFRGS.
- The respondents were all undergraduate students of the Business Administration course, with active registration, between twenty one and thirty four years old.
- The interviews were held in the morning and evening shifts and lasted between ten to fifteen minutes, each.
- The interviews were recorded on audio and video.

### Methodological Procedures of the Survey:

The following statistical procedures were applied to analyze the data generated by the survey:

The pre-test consisted in applying the draft questionnaire to thirty university students. It was conducted on November 30, 2012. The results of the pre-test were analyzed item by item according to frequency distribution and univariate statistics (mean, median and standard deviation), in addition to calculating the index of reliability shown below.



Adjustments were made in the questionnaire related to the question order and with respect to the clarity of the writing in order to improve the reliability of responses. We also included additional variables related to smartphone use, which arose from the analysis of the responses obtained in this step (in particular in relation to the assessment of Consumerization). Based on the responses in this phase, the wording and order of questions was also adjusted in order to improve the segmentation of the sample to evaluate expectation and usability. The population, of an undefined nature, followed the references for respondent profiles of the seminal article on Feature Fatigue (Thompson *et al.*, 2005) in order to collect responses from university students. Out of convenience, the sample was taken from seven courses from three universities in the cities of Porto Alegre, Pelotas, Caxias do Sul, Cachoeirinha, Guaíba and Passo Fundo, all in the state of Rio Grande do Sul. The questionnaires were administered in the classroom, face-to-face, through a physical instrument, to one hundred fifty-three respondents. Data was gathered between December 05, 2012, and January 04, 2013.

According to Hair *et al.* (2009), variables or cases with more than 50% of lost data should be eliminated, but, to the extent that the level of lost data decreases, the researcher should increase this cut-off criterion. For Kline (1988), on the other hand, the data omitted must not exceed 10% of the responses for a variable. Based on these guidelines, a case was excluded if 55% of the data was lost, thus exceeding the limits proposed by both Kline (1998) and Hair *et al.* (2009). After this procedure, the sample consisted of one hundred fifty-two respondents.

Following the guideline proposed by Roth (1994), who suggests the elimination of cases in which an entire block is left unanswered, two more respondents were excluded who did not provide data for block 3 of the instrument, leaving a sample with one hundred and fifty valid cases.

The presence of randomness of omission (MAR - Missing at Random) was also verified, given that the lost data did not reveal a systematic pattern (Hair *et al.*, 2009). To establish this the MARC test was used, which indicated randomness in the omitted data with a significance level of 0.75.

The Kolmogorov-Smirnov test indicated the normality of the sample data for the first twenty six variables. The Cronbach Alpha was calculated for the instrument (first twenty six and interval variables), obtaining an Alpha of 0.913, and a Cronbach Alpha, based on the standardized items, of 0.919. The Cronbach Alpha of the pre-test, after the exclusion of two respondents (excessive data loss - above 50 %), was 0.920.

The sample was composed of sixty six male and eighty three female subjects, representing 44% and 55.3%, respectively. The mean age of respondents was twenty five years old, with a minimum value of seventeen and a maximum of fifty two years old.

With respect to income, 46.7% of respondents had incomes of up to US\$ 475.00, while 18% earned more than US\$ 1,400.00. It is important to stress that 6% chose not to answer this question.

Regarding occupation, 30% were interns, 36% were officially employed (CLT), 11% were public officials and 20% were only students.

Regarding the course, 54.7% of respondents attended the Business Administration course, while the rest could be divided between Mathematics, Technical Professional courses, Law, Public Administration, International Relations, Metallurgical Processes, Public Relations, Advertising and Publicity, Archival science and Librarianship. As to the origin, 54% were students of UFPEL university (city of Pelotas), 22% of IFRS university (city of Caxias), 20% of UFRGS university (city of Porto Alegre) and 4% of the universities: FARGS (city of Porto Alegre), PUCRS (city of Porto Alegre), ULBRA (city of Canoas), CE-SUCA (city of Cachoeirinha) and UPF (city of Passo Fundo).

With respect to the electronic device, 68% of the sample had some type of smartphone, and regarding its use, 54% of respondents used it only for personal purposes, while 43.3% used it for personal and professional purposes. In most cases, the phone was property of the respondent. Only 5% of devices were made available by the company where the respondents worked.

After considering the use, or not, by valid respondents of the device within the company, it was possible to divide the sample into two equal groups, with 49.7% of respondents saying they use the phone inside the company, and an equal percentage saying they don't do this, mostly because of restrictions of the company. When network access was considered, 40.9% of respondents said that the company in which they work does not allow Internet access through the corporate wireless network, and 61.2% stated that the company allows the use of the device for access via the 3G network. The most popular carrier among respondents was Claro® (25 %), followed by Oi®, Tim® and Vivo® with approximately 20% each. Four respondents reported using another carrier and twenty one did not respond.

## Results

In this section the results are presented and analyzed in two steps: first, the implications of the laddering study are presented and then the results of the statistical analysis of the data obtained through the survey.

### Laddering

The goal of this first stage of the study was to observe the relations between the two investigated subjects through laddering interviews. Based on an analysis of the interviews we tried to verify whether the IT Fashion phenomenon had Feature Fatigue as consequence. The results provide tenuous support that IT Fashion can contribute to Feature Fatigue. As can be seen in Figure 1, there were only two occurrences where the respondent indicated that the attributes (excess of features) led to the disuse of the device.

However, other attributes had a greater frequency of responses, which enabled us to identify relevant relationships for the explanation of the behavior of individuals regarding equipment that was acquired within the criteria for IT Fashion. Even though this was expected given the characteristics of the product used as a reference, the attribute that returned the largest frequency was internet access (with forty one occurrences), leaving behind other traditional functions of mobile phones, such as voice calls (1) and SMS Messages (3). This attribute,

however, produced four other sub-attributes: electronic mail (7); access to information (2); access to social networks (7) and instant messaging (5). The remaining attributes with more than two occur-

rences did not present sub-attributes. Only one Means-End chain was complete with at least two attribute-consequence-value occurrences: brand (7) è legitimization è social acknowledgment (2).

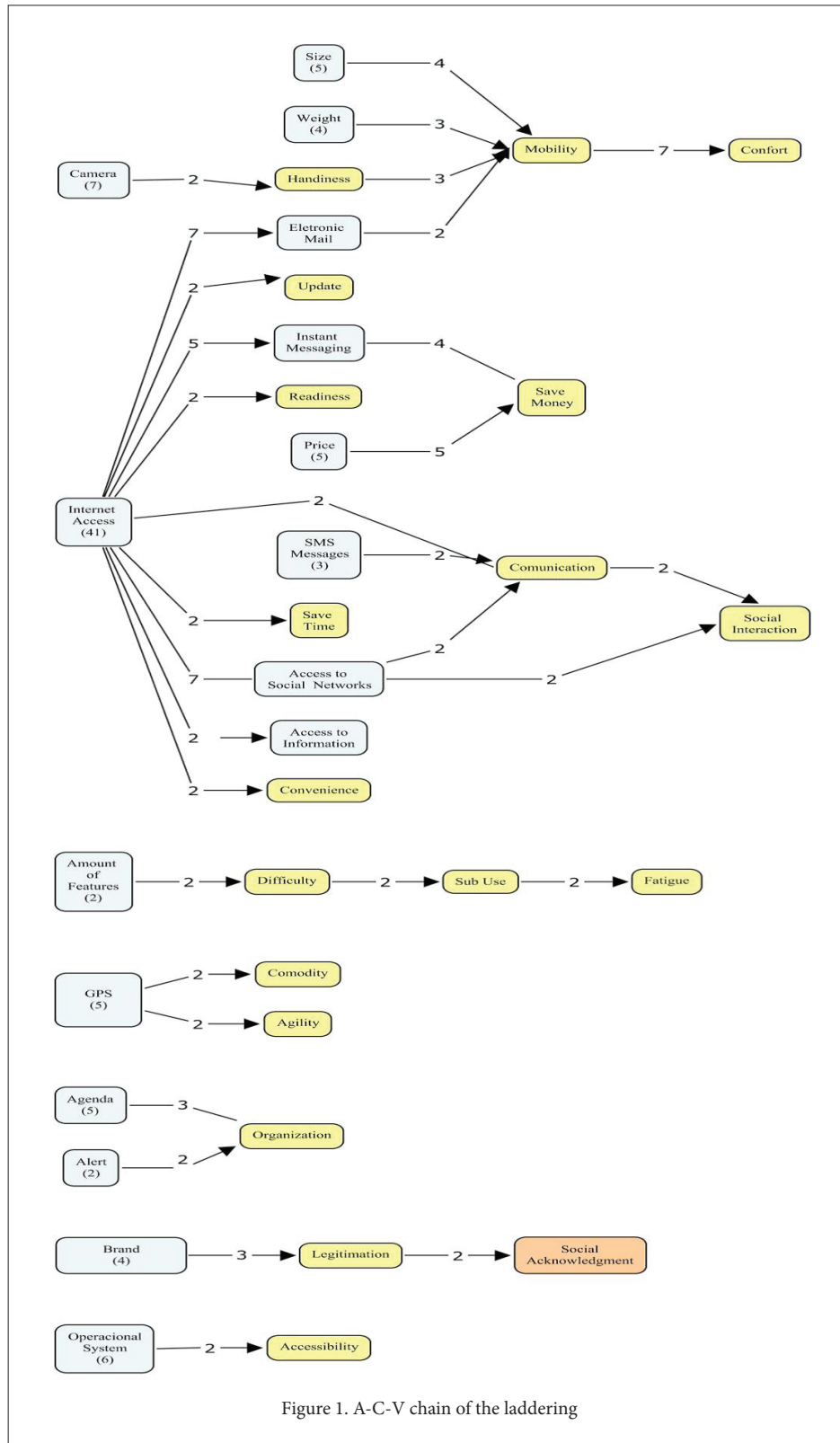


Figure 1. A-C-V chain of the laddering

Most identified chains reached the level attribute-consequence. This did not harm the study, since the objective of employing this technique was not to search for values, but rather to establish relationships between the attributes and their consequent. Just as was the case with the Internet access attribute, which generated other attributes, there was also the occurrence of more than one level of consequences. The physical attributes weight and size, in particular, converged to more than one consequence, until the last level, comfort. The consequent comfort was also related to other attributes, such as e-mail and camera.

In addition to these chains that shared consequents, they also shared consequences, such as SMS and price. Other chains, however, were isolated, with an attribute related only to one consequent (and its subsequent levels), or, at most, to similar attributes. Agenda (5) and alert (2), for example, shared a single consequent, organization (5). These attributes of an established intensive use in cell phones (which had low frequency), such as voice call and SMS, had a high occurrence. This considering the fact that the studied equipment were smartphones with a wide range of features. Regarding the association between IT Fashion and Feature Fatigue, two occurrences suggested that the second phenomenon is strengthened by the first. A chain formed from the high amount of features (2) that the current smartphones have, leading to a greater difficulty (2) to use of equipment, generating its sub-use (2). These consequents coincide with the findings of Thompson *et al.* (2005) on Feature Fatigue (2). One of the respondents even stated that because of this difficulty he downgraded his phone, exchanging his device for one with a smaller number of features.

## Survey

To check for differences between the behavior of two groups: those who practice Consumerization and those who don't (non-Consumerization), a prior division of the sample was made. To analyze if Feature Fatigue would have the same effect in the Consumerization group, we first had to check if the Feature Fatigue phenomenon was present. To achieve this, we looked for differences between the expectation of use and experience of use groups. The sample was divided according to question 6.1 (which made a distinction between experience and expectation of use), classifying the respondents with experience of use as 1, and those with expectation of use as 2, creating the relabeled variable T6.1.

The first difference tests were performed with the above presented division. The remaining tests were carried out by adding a second division: Consumerization and non-Consumerization. The Consumerization group was identified as 2, and the non-Consumerization group as 1, based on the answers to questions 6.6 and 6.8. The variable resulting from the intersection of these two variables was called T6.6.8.

With respect to Block 1, the Levene test revealed that the sample of the two groups were homogeneous for V1.1 and V1.3, because the p-value exceeded 0.05 (0.502 and 0.118). In the same way, the T-test indicated that the groups did not show differences between the averages in V1.1 and V1.3 (see the first line, equal variances assumed: 0.496

and 0.161). In the variables V1.1 and V1.3 the confidence interval can be considered null, since it contains the zero.

However, for V1.2, the Levene test pointed to the homogeneity of the samples, with a significance level below 0.05 (0.028). In this case, the second line of the T-test was observed, equal variances not assumed, where the significance was of 0.009 with an interval of 0.13213 to 0.90619. This shows that for this item (V 1.2) there are significant differences between the experience of use and expectation of use samples.

As for Block 2, of the eight items only the first, V 2.1, was not significant (0.12). For the others the T-test indicated that there are significant differences between the two samples (use and expectation), taking into account homogeneity or non-homogeneity through the Levene test.

For Block 3, only V 6.3 showed significance for the question whether there is difference between the samples (0.38).

Block 4 had a similar result as block 2. It indicated significance of variance between the samples for all items, except for item 4.2. Similarly, in the last block only item 5.4 showed no significant difference between the variance of the samples.

The T-tests per variable, therefore, indicated few items with a significant differences between the expectation and experience of use groups. In block 1, this was only the case for V1.2, indicating that there is a difference in the perception of the advantages resulting from the features of the tool between the two groups. In block 2, on the other hand, the results revealed significant differences for all usability items, except for the capacity to understand and use the device by trial and error.

Block 3 also indicated a greater homogeneity than significant differences in the results. Only V6.3 presented different results between the two groups, indicating that the expected usefulness of the device is different than the perception of usefulness of those using the device.

Block 4, which posed questions about skills, also revealed differences between both groups, except with regard to the need of knowing the characteristics of the product beforehand. Finally, block 5 also revealed differences for all items, except for the one referring to the difficulty of the purchase decision.

Subsequently, we performed a MANOVA to check for differences in use experience and use expectation in the Consumerization and non-Consumerization groups, considering both independent variables tested by the block variables as dependent variables.

The first test was carried out by testing all the twenty six questions. There were significant differences between the groups T6.1 (expectation and use) and T6.6.8 (Consumerization), but when crossed no differences were found. That is, the experience group did not reveal any difference between Consumerization and non-Consumerization. The same occurred with the expectation group.

In the following tests, we analyzed differences by blocks (as dependent variables) and the same differences between groups as independent variables.

Block 1, which deals with the perception of features, only revealed differences between the experience and expectation of use groups. The difference between the Consumerization and non-Consumerization group did not prove to be significant.

On the issue of usability studied in block 2, the results indicated that there are differences between the groups, both for the experience and expectation of use and the Consumerization and non-Consumerization groups. However, the crossing of both groups did not reveal any significant variation.

The block of items that aimed to evaluate the perception of product usefulness did not behave like block 1, revealing differences only between the Consumerization and non-Consumerization groups. The expectation and use samples did not show any significant differences in their means.

Finally, blocks 4 and 5, which measured skills and satisfaction, behaved the same way, with differences only showing up in relation to the expectation and experience of use groups.

Both generally and by blocks no significance was therefore observed when crossing the T6.1 and T6.6.8 variables, indicating that there is no difference between the use and expectation effects and the Consumerization and non-Consumerization effects. Not one case revealed a significant difference in the crossing of the four groups: experience of use, expectation of use, Consumerization and non-Consumerization.

## Concluding Remarks

The present work investigated the existing relations between three concepts that, although distinct, are all related to the same context of technological transformation: Consumerization of IT, IT Fashion and Feature Fatigue. The methodology employed two research steps: a laddering study followed by a survey in order to identify whether Feature Fatigue could be observed in the context of IT Fashion or Consumerization of IT.

In his seminal article, Thompson *et al.* (2005) investigated the presence of Feature Fatigue in users of music players almost a decade ago. Similarly, this study focused its research on the smartphone to study the phenomena mainly because it is a contemporary technology of large and growing social penetration, which is used especially by young people. These electronic devices are characterized by the fact that they are not merely individual devices, but an interconnected technological platform with multiple features that enable the use of social networks, which have been attracting the interest of all social segments, especially young people.

Albeit tenuously, the results of the laddering provide some evidence that consumption motivated by IT Fashion leads to the so-called Feature Fatigue effect. The in-depth analysis of the laddering interviews

reinforces this assessment, since the statements of users obtained after detailed observation do not demonstrate, in most cases, the occurrence of disuse of features. Results that were reported by Thompson *et al.* (2005).

Analyzing the use of smartphones by university students, we observed the occurrence of Feature Fatigue at relatively low levels, as evidenced by the only slightly significant difference found between the expectation (those without experience in the use of their smartphone features) and the experience (who declared themselves as users) groups.

A possible explanation for the differences between the results of this study and Thompson *et al.* (2005), that is, for the lower occurrence of Feature Fatigue in the researched products, could perhaps be credited to the level of customization and adjustment that can be observed in the latest smartphones, which have adopted apps that can be added, modified and replaced as the standard tools to develop and upgrade their products. This becomes significant in so far that it lets users determine which features they want to install or maintain, ensuring independence and the satisfaction of their real needs, instead of the user being forced to learn to use those features determined by the manufacturer of the product.

With respect to the Consumerization of IT, our study did not reveal significant differences between the users of the defined samples with the separation of the groups into those who make only personal use of the equipment and those that also use it professionally, both inside and outside the company. The patterns observed through the survey suggest that the behavior for using technology is quite similar for the cases where Consumerization of IT is observed and those where it isn't. In line with the literature, which characterizes Consumerization of IT as the trend towards dual use (personal and professional) of electronic devices, the analyzed sample reveals a significant number of cases that fall in this category.

The customization of products, such as smartphones, also strengthens the Consumerization of IT trend, in addition to the analogous behavior in those cases where it is not observed, given that specific applications can be suited for either professional or personal use in different locations, interchangeably. The study suggest, therefore, that the influence of IT Fashion is significant in relation to Feature Fatigue, although this effect proves to be less pronounced than would be expected based on the literature. The context of Consumerization of IT, on the other hand, could be observed, but it didn't reveal significant differences regarding the impact on Feature Fatigue, revealing the same behavior between both groups.

## Study Limitations and Suggestions

The present study was applied to a specific product, within the context of analysis and with limited reach, which means the results cannot be generalized. New studies with a greater geographic reach and that consider technologies that have a different application or scope, may be interesting to confirm or reject the results found in this study.

Additionally, the laddering results suggest future lines of research.



From changes in consumer behavior to the development of new features, the configuration of the generated map reveals various chains that could be explored not only by academic research, but also by those organizations involved in the production of equipment, systems and content for mobile devices.

## References

- Abrahamson, E. (1991). Management fashion. *Academy of Management Review*, 21(1), pp. 254-285.
- Baskerville, R. L., & Myers, M. D. (2009). Fashion waves in information systems research and practice. *MIS Quarterly*, 33(4), pp. 647-662.
- Benders, J., & Van Veen, K. (2001). What's in a fashion? Interpretative viability and management fashions. *Organization*, 8(1), pp. 289-309.
- Bernnat, R., Acker, O., Bieber, N., & Johnson, M. (2010). Friendly Takeover The Consumerization of Corporate IT. Booz & Company, Frankfurt.
- Burger, K. (2012). Resistance Is Futile. *Bank Systems + Technology*, p. 6.
- Burton, B., Geishecker, L. S., Hostmann, B., Austin, T., Herschel, G., Soejarto, A., & Rayner, N. (2006). Business Intelligence focus shifts from tactical to strategic. Gartner Research, Stamford. Acesso em 13 de 06 de 2012, disponível em Gartner: <http://www.gartner.com/id=492462>
- Cameron, B., Cullen, A., & Worthington, B. (2008). The emerging technology trends that CIOs should care about. Forrester Research Inc., Cambridge. Acesso em 10 de 04 de 2012, disponível em Forrester - For CIOs Professionals: <http://www.forrester.com/The+Emerging+Technology+Trends+That+CIOs+Should+Care+About/fulltext/-/E-RES46357?docid=46357>
- Carter, M., Thatcher, J. B., Applefield, C., & McAlpine, J. (2011). What cell phones mean in young people's daily lives and social interactions. Southern Association for Information Systems Conference. Atlanta.
- Cazier, J. A., & Hopkins, B. E. (2011). Doing The Right Thing for the Environment Just Got Easier With a Little Help from Information Systems. Sprouts - Working Papers on Information Systems, pp. 1-7.
- Chaka, C. (maio de 2012). Consumerization of IT, Social Computing, and Mobility as the New Desktop. *Cutter IT Journal*, pp. 28-33.
- Cohen, B. (maio de 2012). The Effects of Consumer-Driven Innovation. *Cutter IT Journal - Journal of Information Technology Management*, 25, pp. 6-10.
- Cooper, J. C., & Bess, C. E. (maio de 2012). BYOD Is Not Really About Devices. *Cutter IT Journal*, pp. 20-27.
- Cummings, J., Massey, A. P., & Ramesh, V. (2009). Web 2.0 Proclivity: Understanding How Personal Use Influences Organizational Adoption. 27th ACM international conference on Design of communication (pp. 257-264). New York: ACM.
- Devine, S. M. (abril de 2012). Interview: BYOD and the enterprise network. *Computer Fraud & Security*, pp. 14-17.
- Forrester. (2011). IT managers selectively embrace Consumerization. Forrester Research Inc., Cambridge. Acesso em 15 de 05 de 2012, disponível em Microsoft: [http://download.microsoft.com/download/B/3/A/B3ABAFBF-B96E-496A-8A96-51EAE5091C07/IT%20Managers%20Selectively%20Embrace%20Consumerization\\_FINAL%2002172011.pdf](http://download.microsoft.com/download/B/3/A/B3ABAFBF-B96E-496A-8A96-51EAE5091C07/IT%20Managers%20Selectively%20Embrace%20Consumerization_FINAL%2002172011.pdf)
- Gens, F., Levitas, D., & Segal, R. (2011). Consumerization of IT Study : Closing the "Consumerization Gap". IDC. Framingham: IDC Go-to-Market Services.
- Ginovsky, J. (abril de 2012). "BYOD" quandary: when the "bring your own device" trend comes to the bank,"BYOD" quandary: when the "bring your own device" trend comes to the bank, measure the risks carefully. *ABA Banking Journal*, p. 24.
- Gordon, D. (maio de 2012). What the PC Revolution Can Teach Us About the iConsumerization of IT. *Cutter IT Journal*, pp. 11-15.
- Goul, M., Marjanovic, O., Baxley, S., & Vizecky, K. (2012). Managing the Enterprise Business Intelligence App Store: Sentiment Analysis Supported Requirements Engineering. 45th Hawaii International Conference on System Sciences (pp. 4168-4177). Maui: IEEE Computer Society.
- Grasso, A., & Convertino, G. (2012). Collective Intelligence in Organizations: Tools and Studies. *Computer Supported Cooperative Work*, 21(4-5), pp. 357-369.
- Gupta, M. K. (maio de 2012). The Consumerization of IT and Its Impact on Enterprise Business Applications. *Cutter IT Journal*, pp. 16-19.
- Hair Jr, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (2009). *Análise multivariada de dados* (6 ed.). PORTO ALEGRE: BOOKMAN.
- Katz, R., Goldstein, P., & Yanosky, R. (2008). Cloud Computing in Higher Education. Acesso em 15 de junho de 2012, disponível em Educause: [http://net.educause.edu/section\\_params/conf/CCW10/highered.pdf](http://net.educause.edu/section_params/conf/CCW10/highered.pdf)
- Klinc, R., Dolenc, M., & Turk, Z. (2008). Possible benefits of Web 2.0 to construction industry. CIB W78 25th International Conference on Information Technology in Construction. Santiago: International Council for Research and Innovation in Building and Construction .
- Klinc, R., Dolenc, M., & Turk, Z. (2009). Engineering collaboration 2.0: requirements and expectations. (A. S. Kazi, G. Aouad, & A. Baldwin, Eds.) *Journal of Information Technology in Construction*, pp. 473-488.



- Kline, R. B. (1998). *Principles and practices of structural equation modeling*. New York, NY: Guilford.
- Käffer, S., Fiet, E., & Niehaves, B. (2015). IT consumerization and its effects on IT business value, IT capabilities, and the IT function. *PACIS 2015 Proceedings: Pacific Asia Conference on Information Systems*. The Association for Information Systems (AIS).
- Lamy, L., & McQuire, N. (2010). The consumerization of IT: how are CIOs managing the complexity. *Unisys*. Fonte: Unisys.
- Li, M., & McQuire, N. (2011). Feature fatigue analysis in product development using Bayesian networks. *Expert Systems with Applications*, 38(8), pp. 10631-10637.
- Li, M., Wang, L., & Wu, M. (2012). A multi-objective genetic algorithm approach for solving feature addition problem in feature fatigue analysis. *Journal of Intelligent Manufacturing*, 23, pp. 1-15.
- Li, M., Wang, L., & Wu, M. (2014). An integrated methodology for robustness analysis in feature fatigue problem. *International Journal of Production Research*, 52(20), pp. 5985-5996.
- Love, J. (janeiro de 2012b). The Consumerization of IT: Predictions, Wishes, and Dart-Throwing Monkeys. *Cutter IT Journal*, pp. 18-23.
- Melin, U., Sarkar, P. K., & Young, L. W. (2014). Fashions in the Cloud: A case of Institutional Legitimacy. *Twentieth Americas Conference on Information Systems*, (pp. 1-12). Savannah.
- Monteiro, D. P. (2010). O conceito de valor para o consumidor uma análise sob a Óptica da metodologia Laddering. *Dissertação de Mestrado em Ciências da Comunicação, Marketing e Publicidade*, Universidade Lusófona de Humanidades e Tecnologias, Lisboa.
- Moschella, D., Neal, D., Opperman, P., & Taylor, J. (junho de 2004). *The "Consumerization" of Information Technology*. CSC. London: Computer Sciences Corporation.
- Oliveira, M., Rego, B., Alves, D., Machado, F., & Slongo, L. (2009). Uma comparação entre entrevista face-to-face e entrevista on-line via chat, aplicando-se a técnica laddering. *Gestão e Regionalidade*, 25(75), pp. 57-72.
- Opdenakker, R. (2006). Advantages and disadvantages of four interviews techniques in qualitative research. *Forum Qualitative Sozialforschung*, 7(4).
- Pinsonneault, A., & Kraemer, K. L. (1993). Survey research methodology in management information systems: An assessment. *Journal of Management Information Systems*, 10(2), pp. 75-105.
- Plummer, D. C., Smulders, C., Fiering, L., Natis, Y. V., Mingay, S., Driver, M., . . . Wilson, D. (8 de janeiro de 2008). *Gartner's Top Predictions for IT Organizations and Users, 2008 and Beyond: Going Green and Self-Healing*. Research, Gartner, Stamford.
- Prete, C. D., Levitas, D., Grieser, T., Turner, M. J., Pucciarelli, J., & Hudson, S. (maio de 2011). *IT Consumers Transform the Enterprise: Are You Ready?* White Paper, IDC, Framingham.
- Rahman, M., & Rahman, M. M. (2009). To defeat feature fatigue the right way, understand it first. *Strategic Direction*, 25(6), pp. 26-28.
- Reynolds, T., & Gutman, J. (1988). Laddering Theory, method, analysis and interpretation. *Journal of Advertising Research*, 28, pp. 11-31.
- Roth, P. L. (1994). Missing data: A conceptual review for applied psychologists. *Personnel Psychology*, 47, pp. 537-560.
- Rust, R. T., Thompson, D. V., & Hamilton, R. W. (2006). Defeating Feature Fatigue. *Harvard Business Review*, 84(2), pp. 98-107.
- Saaka, A., Sidon, C., & Blake, B. F. (2004). Laddering: A "How to do it" Manual - with a note of caution. *Research Reports in Consumer Behavior*, pp. 1-34.
- Sen, P. K. (24 de fevereiro de 2012). Consumerization of IT - Drivers, benefits and challenges for NZ corporates. *School of Information Management*, Victoria University of Wellington, Wellington.
- Shuster, E., & Kalamarides, A. (2012). *Thriving in a BYOD world*. IntelliClear. Colorado Springs: IntelliClear.
- Suchman, M. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, 20(3), pp. 571-610.
- Surowiecki, J. (2007). Feature Presentation. Acesso em 18 de 05 de 2012, disponível em *The New Yorker*: [http://www.newyorker.com/talk/financial/2007/05/28/070528ta\\_talk\\_surowiecki](http://www.newyorker.com/talk/financial/2007/05/28/070528ta_talk_surowiecki)
- Thompson, D. V., Hamilton, R. W., & Rust, R. T. (2005). Feature Fatigue: When Product Capabilities Become Too Much of a Good Thing. *Journal of Marketing Research*, 42, pp. 431-442.
- Titus, P., Desai, C. C., Greer, R., Kuhn, J., & Duckering, B. (2012). *State of mobility survey*. Survey, Symantec, Mountain View.
- UIowa. (2007). *The impact of consumer technology*. University of Iowa - Tech Forum, Iowa.
- Wang, P. (2010). Chasing the Hottest IT: Effects of Information Technology Fashion on Organizations. *MIS Quarterly*, 34(1), pp. 63-85.
- Wong, W. (junho de 2012). *BYOD: the risks of bring your own device*. Risk Management, p. 9.
- Yourdon, E. (2011). Vivek Kundra - First CIO of the USA. In: P. Manning (Ed.), *CIOs at work* (pp. 299-308). New York, NY: Springer Science.

# Obstacles to Small Innovative Companies' Development: Case Study of Nizhny Novgorod Region

*Nadezhda Butryumova*<sup>1\*</sup>, *Svetlana Karpycheva*<sup>1</sup>, *Khristina Grisheva*<sup>1</sup>, *Elena Kasyanova*<sup>1</sup>

**Abstract:** The article presents the survey results of obstacles to small innovative companies as a case study of Nizhny Novgorod region of Russia as an area with high innovative potential and great level of socio-economic indicators. Based on the semi-structural personal interviews with 19 experts - the management of support infrastructure, results shows some typical for this region impediments: bureaucracy; lack of trust, poor collaboration within the innovation system; poor information support; legislative obstacles to innovations and intellectual property protection; low interest of large companies in collaboration with small ones. The findings and recommendations can help policy-makers to meet the needs of small innovative companies, and increase the innovative activity of small firms through the improvement of the assistance programs.

**Keywords:** small innovative companies; innovation infrastructure; obstacles; case study; Nizhny Novgorod region, Russia.

Submitted: April 30th 2015 / Approved: December 2nd 2015

## Introduction

Different research shows that innovative ventures give more social and economic input than non-innovative, owing to the fast growth of small innovative companies, especially in the high tech industry (Geroski, 1995; Weigand & Audretsch, 1999).

Small innovative companies face high risks and high costs when they launch innovative products and implement innovative processes. The effectiveness of the process of commercialization of innovations by SME is dependent on their collaboration with infrastructure and technology support network for innovation development (Zeleny, 2012). In order to increase the innovation activity and survival of SMEs at the regional level, it is necessary firstly to conduct a systematic analysis of the obstacles to their innovation activity that concern functioning of innovative infrastructure, and secondly, to improve rules and institutions to reduce the obstacles. It proves the relevance of the suggested research topic.

Good governance affects innovation across several dimensions. Government policy determines the regional infrastructure and significantly influences innovations (Sivak *et al.*, 2011). Economic growth of the country depends on the economic growth of its regions that vary within the country (OECD, 2013). The right policy and coordination among different levels of administration can improve competitiveness of underperforming regions. Thus it is very important to investigate conditions for small innovative companies' development at a regional level. Such conditions depend on the innovation infrastructure of the region.

In accordance with the Federal Law on Science and State Science and Technology Policy 1996 innovation infrastructure of the region is represented by the organizations that enable and assist implementa-

tion of innovative projects, including the provision of administrative, logistics, finance, information, personnel, and organizational consulting services. Innovative infrastructure can be divided into several types depending on the kind of support such organizations provide: financial, information, consulting and business service, personnel, industrial and technological infrastructure (Dezhina, 2005).

According to the Global Innovation Index report in 2013 Russia occupies the 51st place out of 141 in terms of innovation development ("The Global Innovation Index 2013. The Local Dynamics of Innovation," 2013). At the same time only 5.1% of Russian small companies were engaged in technological innovation in 2011 (Ramos-Vielba & Fernández-Esquinas). It shows the relevance of increasing the innovation activity in Russia and paying attention to the obstacles to innovations for SMEs.

Considering significance of SMEs for the economic development and importance of innovations, we need to identify issues and factors that negatively affect the development of small innovative businesses in the Russian regions with high innovative potential and great level of socio-economic indicators. Nizhny Novgorod region is a good case of such an example.

Choosing the Nizhny Novgorod region as the research object is justified by high levels of social, economic and innovative development in the region. The region took the fourth place in the ranking of innovative development in 2012 (Gokhberg, 2014). In the ranking of innovative activity of regions, Nizhny Novgorod was at the fourth place (Silvernagel *et al.*). However, we can see a low level of innovation activity of small business in this region. We can presume that there are significant barriers in the region to the development of small innovative companies.

<sup>1</sup> Venture Management Department, National Research University Higher School of Economics.  
Corresponding author: nbutryumova@hse.ru



The suggested article presents and analyses the results of the survey conducted in 2013 in order to solve that problem and find unique obstacles for such regions. Based on the semi-structural personal interviews with 19 experts representing the management of the organizations of innovation infrastructure, the issues typical for this region have been identified.

The findings could be helpful to the policy-makers in their attempt to meet the needs of small innovative companies and adjust the existing assistance programs. The suggested recommendations may help governments to increase the innovative activity of small firms in their regions. It could also help other countries to anticipate the same issues and adapt their policies to possible impediments that their SMEs may face.

This way, researchers can use the results of this investigation as hypothesis for their study, and verify the presence of such obstacles in the considered region.

The paper consists of several parts. The literature review introduces the general obstacles to innovations and the particular issues that small innovative companies may face. The next section presents the selected region and explains the methodology of the research. The "Results" section describes and analyses the identified barriers. The last section summarizes the research findings, compares the obtained results with Russian and foreign researchers, and provides directions for the future research.

### Obstacles to innovations faced by SMEs

Impediments to innovation decrease the innovative activity of firms, and it is crucial to overcome them. A high risk and low level of survival of small innovative firms make it necessary to improve this activity by identifying and overcoming barriers and obstacles to innovation ventures. The issue of the barriers raises concern of a large number of scholars who discuss it from different points of view. Some authors consider barriers to innovations in general, other researchers study only obstacles to innovations for SMEs. The major part of the existing research seems to be focused on the general obstacles to innovations. Most of papers divide impediments into two categories: internal and external.

One of the first studies of this topic was conducted by Piatier in Europe. He identified barriers to innovation created by external and internal environment and ranged them into five enlarged groups that cover a wide spectrum of smaller ones: research and development (R&D) policies; general, economic, and social policies; activity of the national private sector and universities; innovation climate; foreign countries. Policy, climate, legislation, and standards were included in the list of the strongest barriers (Piatier, 1984). Some researchers investigating barriers to innovations in different national and industrial contexts divide the identified barriers into the same categories: internal and external. But these obstacles are more specific than Piatier's ones.

In the other part of works the specific attention is paid to the obstacles

to innovations faced by SMEs. A survey of high-tech enterprises conducted in China shows that the more innovative a company is, the more obstacles it meets, but some barriers do not depend on the innovation activity of the company (Huang & Chi, 2013). For instance having assessed the impact of such barriers it was found out that the most critical impediments referred to the external factors and they could be divided into several groups: financial, personnel, services of support infrastructure, access to the information.

As a result of literature analysis we can find several impediments to innovations that are mentioned in the majority of studies. In this paper we study external obstacles for small innovative companies from the innovation infrastructure point of view.

The authors considered the emphasis on the lack of financial resources to be the strongest factor affecting the innovations in small firms. The research undertaken in Italy shows that the need of additional financing decreases the R&D activity of Italian manufacturing SMEs (Mancusi & Vezzulli, 2010). The results show that barriers concerning managers' perceptions of issues related to costs are stronger for small companies, and issues related to human resources are more important barriers to innovation for medium-sized firms (Madrid-Guijarro *et al.*, 2009).

Such obstacle as lack of an appropriate source of finance for innovation companies was identified by several scholars and it means unfavorable bank credit policies, shortage of venture capital (Galia & Legros, 2004; Hadjimanolis, 1999; Larsson, 2004; Madrid-Guijarro *et al.*, 2009; Mohnen & Roller, 2005). Barriers for SMEs related to finance in different papers concern such issues as: high cost of development; difficulties of costs control; lack of financial capital; difficult access to financial resources (Huang & Chi, 2013; Madrid-Guijarro *et al.*, 2009; Tourigny & Le, 2004; Xie *et al.*, 2010).

Labor-related problems were discussed by many researchers and they concern the shortage of skilled and qualified personnel (Arundel, 1997; Baldwin & Lin, 2002; Galia & Legros, 2004; Hadjimanolis, 1999; Larsson, 2004; Madrid-Guijarro *et al.*, 2009; Mohnen & Roller, 2005; Vrgovic *et al.*, 2012). Personnel-related obstacles for SMEs are more specific than for large companies: inability to devote staff on an ongoing basis in the process of creating innovations due to production requirements; lack of skilled and qualified personnel; lack of technical experts (Huang & Chi, 2013; Madrid-Guijarro *et al.*, 2009; Tourigny & Le, 2004; Xie *et al.*, 2010).

Information-related problems refer to the lack of information on technology and markets as well as dissemination of information (Arundel, 1997; Baldwin & Lin, 2002; Galia & Legros, 2004; Larsson, 2004; Mohnen & Roller, 2005; Vrgovic *et al.*, 2012). Information-related barriers to SMEs in papers concern the lack of technical information (Xie *et al.*, 2010).

In literature we can find barriers related to the market. Some papers consider supply of innovations and market conditions (Baldwin & Lin, 2002; Mohnen & Roller, 2005; OECD, 2005). Others mention

lack of customer responsiveness to new goods or services (Galia & Legros, 2004; Larsson, 2004). The third part of papers concerns lack of opportunities for cooperation with other firms and technological institutions (Mohnen & Roller, 2005). In papers we can find one more market-related obstacle to innovations from the competitors' side: innovation being too easy to copy (Hadjimanolis, 1999).

On the one hand innovative companies face a shortage of resources because of high costs of their activity (Baldwin & Lin, 2002; Galia & Legros, 2004; Larsson, 2004; Mohnen & Roller, 2005; OECD, 2005; Vrgovic *et al.*, 2012). On the other hand they are excessively sensitive to the economic risks (Galia & Legros, 2004; Larsson, 2004; Madrid-Guijarro *et al.*, 2009). As innovation activity is too costly and risky, companies which are going to start innovation activity can need some support. Such impediments as insufficient government support and lack of government assistance were marked in some papers (Hadjimanolis, 1999; Madrid-Guijarro *et al.*, 2009). Support services are more demanded by SMEs that is why we separately submit the following obstacles: lack of technical support and weakness in the technology market; insufficient government support (Huang & Chi, 2013; Madrid-Guijarro *et al.*, 2009). In order to reduce risks and to support innovative companies we can see special infrastructure in the regions (from buildings to services) including technology support network. So, several scholars note the lack of regional infrastructure as a barrier to innovations (Scozzi *et al.*; Sharma *et al.*, 2012; Zeleny, 2012).

It is necessary to note the institution-related problems. Besides they concern government bureaucracy, insufficient flexibility of regulations or standards, legislation, and taxation (Arundel, 1997; Baldwin & Lin, 2002; Galia & Legros, 2004; Hadjimanolis, 1999; Larsson, 2004; Mohnen & Roller, 2005; OECD, 2005; Vrgovic *et al.*, 2012).

### Russian context

In Russia we can find some studies that analyze factors affecting innovation activity of Russian companies. Statistical annals identify indicators of innovation activity of Russian companies including the rating of factors hindering technological innovations in Russia. They study all types of Russian companies from such industries as extractive and IT. The results show that the most significant factors are typical for other countries, but there are some impediments that are different: shortage of the legislative norms for innovation activity, uncertainty of economic outputs from the intellectual property use, a low innovation potential of the company, and undeveloped innovation infrastructure (Gorodnikova *et al.*, 2014). In some other research we can see the same significant factors, but authors stress the lack of legal norms that regulate and support innovation activity as another main barrier (Kazakova *et al.*, 2009).

We cannot find any papers measuring impediments to innovations for small companies in Russia. However, hindering factors for small business in Russia are studied annually by the GEM team. The object of the research is entrepreneurship at different phases including new business and established business that belong to a small business category. In 2012 they identified several most important structural fac-

tors that, from the experts' point of view, influence the small business in Russia: access to finance, implementations of the innovations, government programs, barriers to market entry, bureaucracy, education, and government policy. Additionally, they have determined factors affecting the small business most seriously exactly in 2012: government policy, social and economic situation, financial support, and education (Verkhovskaya *et al.*, 2013).

In this paper we identified obstacles to small innovative businesses in the Russian regions with high innovative potential and great level of socio-economic indicators. Nizhny Novgorod region was chosen as typical case of such a region due to several reasons. Nizhny Novgorod region has high levels of social, economic and innovative development in the area. The region took the fourth place in the ranking of innovative development in 2012 (Gokhberg, 2014). In the ranking of innovative activity of regions, Nizhny Novgorod was at the fourth place (Silvernagel *et al.*, 2009). This area has a lot of scientific institutions, universities and large companies representing different industries.

The Nizhny Novgorod region was studied previously. As a result of 30 interviews with small innovative companies the main issues faced by small innovative businesses were found out: lack of venture capital and grants for small innovative companies; investors' decision-making opacity; inefficient information exchange in the community; a number of issues related to technology transfer (Aleksandrovsky *et al.*, 2011). However, the opinion of companies cannot ultimately reflect the real situation and it is important to study the opinions of experts and representatives of support infrastructure, which work closely with small innovative companies and understand the barriers from the other side. In that research we focused on the opinion of representatives of innovative infrastructure.

Federal Law on Science and State Science and Technology Policy (1996) gives a broad interpretation of the term innovative infrastructure and defines it as a set of organizations contributing to the implementation of innovative projects, including the provision of administrative, logistical, financial, information, HR-related, advisory and organizational services. Dezhina (Dezhina) divides elements of innovation infrastructure into five main types: financial, information, consulting and service, personnel, industrial and technological infrastructure.

It can be summarized that obstacles to small innovative companies have been widely studied in Russia and abroad and there is a number of typical barriers. Despite a great number of works devoted to the development of innovative business barriers at the regional level, there seems to be a gap in the study of the factors associated with the functioning of innovative support infrastructure.

So in our research we need to understand what kind of factors concerning the innovative and support infrastructure for small business exist in Russia, how they are different from foreign countries, but typical for regions with a high level of economic development and innovative activity on the whole.



Therefore, the following research problem can be formulated as follows: regions with high scientific and innovation potential have their own particular external obstacles concerned collaboration among companies and innovative infrastructure.

## Methodology

The choice of the Nizhny Novgorod region as the object of the research can be justified by its high level of socioeconomic and innovation development. It is a typical region with a high level of science and innovation potential, as well as economic development. It includes high concentration of scientific industrial companies and research facilities. In 2012 this region occupied the fourth place in the Russian Regions Innovation Ranking (Gokhberg, 2014). In 2012 the National Association of Innovation and Development of Information Technology also rated innovative activity of Russian regions where the Nizhny Novgorod region occupied the fourth place. In our days there are 39 scientific institutions, 21 design bureaus, 14 Universities and 16 industrial research and development centers (Saavedra, 2009) (Saavedra, 2009). Additionally, regional business-incubators, tech-parks, financial institutions such as business-angels network and venture fund are existed in the region. So, as a result we can see a lot of technological companies that were established over the last several decades in this region. All these factors as usual show a high level of involvement of small business into the innovative processes. At the same time we can see a low level of innovative activity of small business in the region.

However, certain barriers exist to the development of small innovative companies in the region. Preliminary research findings show that Nizhny Novgorod region hosts a number of different organizations that support small innovative businesses and provide the necessary services in all major areas of innovative infrastructure. It is therefore essential to find the key issues in financing, marketing, manufacturing and etc., main barriers hindering small innovative companies' development at the regional level.

In spite of the existence of different organizations enhancing innovative infrastructure in the region, not all of them fulfill their functions and fully satisfy their customers.

The overall goal of the research was to identify the barriers to development of small innovative companies in the Nizhny Novgorod region and find unique obstacles for such regions.

The research is based on the findings from previous studies conducted by Gokhberg (2014), the OECD (2005), and the outcome of the empirical study specially designed for this research.

According to the aim of the research, it is a case study, where we used qualitative methods in order to understand the functioning of key organizations that support innovative companies. The most appropriate method for data collection for such type of research would be the semi-structured personal interview (Sekaran, 2003). The guide for

the interview was designed according to the type-specific problems of infrastructure.

Having considered a number of works to identify the problems of development of small innovative companies in different regions, the range of barriers was determined. The areas described below were used as the basis for the current study and for the compilation of interview questions.

*Intellectual property protection.* In this section experts answered the question of whether it is difficult to protect intellectual property in the region. Certain constraints such as protection of intellectual property exist only in Russia because of the lack of the international commercialization strategy (Gutierrez & Correa, 2012).

*Financial support of small innovative companies.* In this unit the experts estimated the level of availability of financial resources for small innovative companies, how easy it is to get a grant or to find a private investor. Among the barriers in financial infrastructure it is possible to identify the lack of proprietor funds of project developers, the limited public funding (Doloreux, 2004; Kazakova *et al.*, 2009; Madrid-Guijarro *et al.*, 2009; Savignac, 2006; Sharma *et al.*, 2012; Silva *et al.*, 2007; Vermeulen, 2005; Xie *et al.*, 2010), a small number of venture capitalists (Sharma *et al.*, 2012), the high cost of new product development (Doloreux, 2004; Silva *et al.*, 2007; Tourigny & Le, 2004).

*Information support and availability.* In the information section it was important to get answers to questions such as how the leaders of innovative projects are aware of the possibilities of state support for innovation, and about the organizations that provide services and support to innovative companies and projects, whether it is difficult to find the necessary information for the project in free access. Constraints of the information infrastructure included: the lack of information and support from the state (Doloreux, 2004; Madrid-Guijarro *et al.*, 2009; Silva *et al.*, 2007; Xie *et al.*, 2010).

*Consulting support in the region.* The questions in this section were to find out whether small innovative companies appeal to third party services, what services they want to get access to. Barriers from consulting, and business service infrastructure, according to the foreign researchers, are the lack of opportunities for cooperation with other enterprises (Doloreux, 2004; Madrid-Guijarro *et al.*, 2009; Tourigny & Le, 2004).

*Education sphere and personnel.* In this block the experts were asked to evaluate the level of competence of the team of innovative projects, what kind of competences they lack, if they have problems with finding, attracting and retaining qualified staff. Among barriers in the sphere of education can be named the insufficient amount of special educational programs in the field of entrepreneurship and small innovative business development, low qualification of the personnel (Madrid-Guijarro *et al.*, 2009; Tourigny & Le, 2004), low and, consequently, uncompetitive average earnings for researchers in the global market (Gutierrez & Correa, 2012), low quality of education,



poor understanding of customer needs, the lack of knowledge on the development and commercialization of project management skills, skilled labor deficit (Doloreux, 2004; Kazakova *et al.*, 2009; Sharma *et al.*, 2012; Silva *et al.*, 2007; Vermeulen, 2005; Xie *et al.*, 2010).

*Other factors.* It is important to ask firms about other problems that they face in the implementation of projects, so in this unit experts were interviewed on the legislation in the sphere of innovation, bureaucracy, about the economic risks of innovation. Barriers from the organizational and production infrastructure include the difficulty of getting access to university laboratories (Doloreux, 2004). Corruption, bureaucracy and legislative weaknesses are also constraints for Regional Development (Kazakova *et al.*, 2009; Sivak *et al.*, 2011; Vermeulen, 2005) and high economic risks (Silva *et al.*, 2007; Tourigny & Le, 2004).

Results of a similar study gave additional information about the situation in the region. Previous research was conducted in Nizhny Novgorod region in 2011, and management of small innovative companies was interviewed. The authors examined the following issues: protection and use of intellectual property, finance, interaction with suppliers, information support, and collaboration with other participants of the innovative infrastructure (Aleksandrovsky *et al.*, 2011). To meet the aim of the research it is necessary to cover additionally representatives of the innovation infrastructure of the Nizhny Novgorod region.

In order to find referent experts for the interview, first of all we analyzed the database of organizations of innovation infrastructure in the Nizhny Novgorod region that was provided by the Ministry of Industry and Innovation of Nizhny Novgorod. According to the Ministry, the database consists of 36 organizations of innovative infrastructure in the Nizhny Novgorod region. Next, organizations from the base were divided into blocks in accordance with the type of support they provide, their aims and functions. Then the information on each was taken from secondary sources by its activity level in the region as a support organization in terms of innovation (participation in events for small innovative business, such as conferences, educational programs, fairs, business-plan competitions and so on; the flow of projects seeking the help from these organizations). Additional information about these organizations was received from the previous study, where the respondents were SMEs. In the end we selected the most active organizations from each group, so that we found out 19 representatives of innovative infrastructure.

To conduct interviews for this study the heads of the selected organizations were taken, because they own comprehensive information

about the innovative development of the region.

Based on the selected type of infrastructure, interviews were held with following experts (more detailed information about experts is presented in the Appendix A):

- Financial infrastructure: representatives of grant programs, the Head of the Business Angels Association and the regional venture fund (3 respondents in this study) ;
- Industrial and technological infrastructure: representatives of business incubators, technology parks and the Innovation and Technology centre (4 experts);
- Information infrastructure: top management of the scientific information center; chief editor of a specialized journal, top-management of information resources for the actors of the innovative system (3 interviewees);
- Education and human resources infrastructure: managers of university programs teaching and training innovative managers and specialists in commercialization of innovations (4 respondents);
- Expert consulting infrastructure: leaders and experts from organizations supporting small innovative companies in the region (business incubators, centers for entrepreneurship, venture partner of RVC Seed Fund, consulting and intermediary organizations, innovation and technology centers) (5 experts).

The representatives of the target group gave the information about the Nizhny Novgorod case in the form of personal interviews. All interviewers used tape recorders and spent around 30 minutes on each personal interview. In total 19 interviews were conducted in 2013.

For the analysis of the interviews, each block of questions was considered separately. A number of barriers that each respondent identified was drawn up for each block of questions. As a result, the most popular barriers in each block of questions were identified.

## Results

In this part of the article the results of the research are presented. They are grouped by the type of infrastructure: financial, information, consulting and business service, personnel, industrial and technological infrastructure.

As the result of the survey, the most important barriers to the small innovative companies' development in the region have been defined for each type of infrastructure (Table 1).

Obstacles	The number of experts noted this problem
<i>Personnel infrastructure.</i> The region has a shortage of qualified project managers, experts in the field of venture capital investment, skilled marketing experts and engineers.	16
<i>Consulting infrastructure.</i> Teams of small innovative companies usually involve technical staff, but have a gap of competencies in sales, management and marketing.	13
<i>Financial infrastructure.</i> The procedure for obtaining grants is complex and bureaucratized. There is a shortage of venture capital for the seed stage.	10
<i>Information infrastructure.</i> The low level of awareness of small innovative companies and other participants in the innovation system about events and activities, procurement and types of support.	8
<i>Industrial and technological infrastructure.</i> Universities currently have only a technical base (special laboratories, equipment and technical facilities), but do not seem to provide enough consulting, mentoring and business services.	7

Table 1. Number of experts noted the most popular barriers in each type of infrastructure.

### Personnel infrastructure

This set of issues describes the educational component of the infrastructure of the region and that of the innovative projects staff.

The table shows that 16 people out of 19 mentioned as the main barrier in the area of personnel the shortage of qualified project managers, experts in the field of venture capital investment, skilled marketing specialists and engineers in the region.

*Vice President of innovation activity of the research university:* “We can see that teams of the projects at the seed and pre seed stages consist only of technical experts and research managers. Teams, which include consultants and have an efficient structure (board of directors, people who is responsible for finance and for marketing) can be found very rarely. They do not conduct any market analysis, they do not know consumers and do not know how to design a financial model, how to attract consultants to the Board of Directors and competently protect intellectual property of the project.”

Some experts indicate that the region lacks experts in the intellectual property management (patent attorneys, lawyers specializing in disputes related to intellectual property protection). Problems connected with the protection of intellectual property exist mainly in Russia. This is due to weak legislation in this area. However this obstacle is typical only for the Nizhny Novgorod region.

### Consulting infrastructure

This block includes questions related to consulting and business service support of small innovative companies.

Small innovative companies’ teams usually involve technical staff, but have a gap of competencies in sales, management and marketing. In

this study 13 respondents mentioned this barrier as the most important one. According to the experts, they experience shortage of such services as: market research and promotion of the company; clients search; getting patents, permits and certification; legal support in the intellectual property management; business accounting services; finding and attracting grants and investments.

*The Director of the Association of Business Angels:* “Now more companies are turning to the services of third parties. At different seminars for small innovative companies we constantly call for collaboration with professionals, because without competent management and marketing it is impossible to bring the project to the market.”

The barriers listed above are characteristics for many regions where small innovative companies are actively developing. In the investigations of Larson (2004), Mohnen and Roller (2005), Mancusi and Vezzulli (2010), Zeleny (2012) these issues in the field of consulting are of paramount importance.

However the study of each region can identify its unique challenges. For the Nizhny Novgorod area such barrier is the poor current service from business-incubators, innovation centers, universities and other organizations that cannot meet needs of small innovative companies. Market services of consulting agencies are too expensive for small businesses.

At the same time, universities do not seem to create favorable conditions for the development of innovative projects. Moreover, there is an unmet need for mentoring to package and support projects, and to hold negotiations with potential customers and investors. It is difficult to attract businessmen to be mentors and work with small innovative companies teams. The system of payment for their help is only to be created.

## Financial infrastructure

This group describes the availability of financial resources for small innovative companies. Most experts believe that for the project team it is difficult to attract both public and private capital for business development for a number of reasons.

The first problem mentioned was the lack of financing for high-tech projects at the seed stage. The procedure for obtaining grants is complex and bureaucratized. Venture capital for the seed stage is missing. These problems have been identified in studies of other authors, such as Larson (2004), Huang and Chi (2013), Aleksandrovsky, Butryumova and Nazarov (2013), Hadjimanolis (1999), Baldwin and Lin (2002), Mohnen and Roller (2005). In this study it is found that 10 out of 19 experts have noted these problems.

*A representative of the business-angels network: "As small businesses often say one of the most serious and important issue is initial funding. They do not have their own money to finance the project."*

The next deterrent regards private investors. The respondents indicated that private investors tend to fund less risky, fast payback and small investment projects. However, if the project has already attracted a grant, it will be much easier for the team to obtain investment from private investors. Hadjimanolis (1999), Mancusi and Vezzulli (2010) have also revealed such challenges in the studies of other regions.

These problems highlighted by many researchers are typical for any region in many countries all over the world. But the Nizhny Novgorod region has unique challenges peculiar only to this area. The first barrier is people's incompetence. Many of the projects that applied for the investment were not attractive for investors for several reasons: the majority of the teams do not have enough experienced and competent staff; many projects failed to undertake the previous study of the market and competitors; business model and financial model of the project were poorly designed. Presentation and negotiation skills are largely absent when communicating with potential investors. Besides, market services of consulting agencies are not available for small businesses because they lack money.

Representatives of the financial infrastructure noted a weak flow of innovation projects that applied for any support in the region.

## Information infrastructure

This group describes the innovative projects teams' awareness of the opportunities of the government support for innovation in the region, activities carried out and the availability of various databases of intellectual property objects, events, participants of innovative market and etc.

In the table above we can see that 8 respondents pointed to the main problem in this block as the low level of awareness of small innovative companies and other participants in the innovation system of activities, procurement and types of support. The information about competitions, grants, tenders is either closed or not widely publicized. There are problems concerning the poor organization of the informa-

tion resources in the Internet, a narrow focus, and the lack of sites collecting and presenting all the necessary information in one place. Such barriers encounter in many areas around the world, including the Nizhny Novgorod region, and such researchers as Baldwin and Lin (2002), Larson (2004), Mohnen and Roller (2005) identified these barriers in their studies.

*The representative of a scientific research university: "Only the most advanced participants are aware of ongoing activities. This is a smaller part consisting of the business people who are always looking for opportunities how to reduce the financial burden that falls on their company at the expense of certain grants, subsidies and etc. People of science are usually not aware of the support programs."*

The research participants indicated the obstacles that are specific only to this region. For instance, a low standard of organization of events dedicated to the development of innovative companies and projects. Organizers of such events often chose the inconvenient time and place, combine multiple activities in one place to decrease costs and attract more visitors (but not the target audience). It leads to the loss of interest in such events and, moreover, to the low level of collaboration among actors of the innovation system.

Another major problem indicated is a low interest in such events from the part of large businesses. Many respondents have noted that such activities should be funded by large business. However, it will happen only in case of the increase of demand for innovative products of small businesses in the region.

## Industrial and technological infrastructure

The questions in this section relate to the functioning of technology parks, business-incubators, shared facilities centers, and innovative infrastructure in the universities.

The main obstacle in this sphere which is marked by 7 experts in the interview, according to the table above, is that universities currently have only a technical base (special laboratories, equipment and technical facilities), but do not seem to provide enough consulting, mentoring and business services.

The region also lacks incubators or specialized centers based in the universities (e.g., proof of concept centers), that would involve the academic community in the processes of technology transfer and would help to create and develop innovative projects.

*The representative of the Venture Fund of the Nizhny Novgorod region: "Business incubators are a very effective mechanism to support companies of the Nizhny Novgorod region. Business incubators are developing in the universities now. However there is lack of innovative managers who could facilitate these processes. There is a shortage of competent people who are able to develop these processes. Basically, the whole businesses are built on human relations in the team."*

Besides, according to the experts, there is a shortage of prototyping centers and centers of test batch manufacturing in the region as it is not

profitable for large enterprises to produce small batches of products. Moreover, the existing industrial parks mostly focus on IT-industry and do not have specialized areas, equipped for production. These issues are typical for the regions where the development of innovative business has begun only recently, including many regions of Russia. Kazakova, Nasedkina, and Frantsuzova (2009), Huang and Chi (2013), Tourigny and Le (2004) also found such barriers in their studies.

As a result of this research some problems have been brought out, which are not presented in other regions. Several types of incubators and technology parks' services exist only on paper and are not provided in reality. Consulting support to the residents of incubators and technology parks is provided by the staff of these organizations, they do not have any means to pay for professional services from external experts.

The interviewees noted a weak influx of residents to the existing incubators and technology parks. The number of projects that meet their requirements is extremely small. It can be thus concluded that projects need to be accompanied and mentored already at the seed stage, before entering the incubators.

The problems mentioned during the interviews additionally include constraints that are related more to the functioning of the entire innovation system rather than to a specific type of innovation infrastructure.

The majority of such issues concern intellectual property protection and the process of technology transfer. Poor legislation for intellectual property protection and low penalties for companies that infringe intellectual property rights lead to a low demand for the services of lawyers and low incentives to undertake an innovation activity on the whole. The lack of demand for innovations from the industry on the one hand and innovation supply from the scientific community mismatches the industry need on the other hand. Weak motivation of scientists to commercialize their intellectual property is rooted in the high risk of such activity. It hinders the development of the intellectual property market.

The other issue named by the experts is the unfavorable business climate in the country, in particular, insufficient incentives and benefits for small innovative companies. Low trust among actors of innovation system leads to poor cooperation. Moreover, some features of the innovative infrastructure are either duplicated or missing, so the system obviously has operational deficiencies.

## Conclusions

The study attempted to identify the problems and factors affecting the small innovative companies' development, which arise from the interaction between them and the innovation infrastructure of the Russian regions with a high innovative potential and high level of socio-economic indicators.

The barriers identified by large Russian companies and other experts (Gorodnikova *et al.*, 2014; Kazakova *et al.*, 2009; RVC, 2010) demon-

strate the general problems for innovations in the Russian economy, but do not focus on the specific features of small business. The suggested research was aimed at confirming several impediments faced by both small and large companies, such as bureaucracy, underdeveloped legal framework, lack of finance, insufficient state support for innovation, low innovation potential of companies and lack of high-skilled staff, lack of information about new technologies and markets, and weakness of cooperation links.

To recapitulate, the project is an attempt to enhance our understanding of problems in the innovation sphere in the region. The study revealed that in addition to the previously identified barriers, there may appear other restrictions to the innovation development, such as a bureaucratic process of reception and expenditure of the public funds allocated to the project; the low level of projects' elaboration; poor organization of the information resources; weak awareness of the participants of innovative system of the activities of each other and of the support programs; the weak system of providing innovative companies with available services of the third-party organizations; lack of specialists in intellectual property management.

The findings prove the systemic issues that were identified in the previous research of managers of small innovative companies undertaken in the Nizhny Novgorod region in 2011. However the present analysis has revealed some issues specific to small innovative companies in the region. The main differences in opinions were in the degree of projects preparedness and investor activity. According to the experts, the projects submitted to various funds were poorly designed and needed the packaging support to attract funding, whereas the project developers were mostly unable to do that themselves. In the opinion of the leaders of small innovative enterprises, investors were too critical about the projects, refused to invest in a risky business, required a major share of the company, and interfered in the operational management of the company. Additionally authors of the projects do not trust investors and they are afraid that the main know-how can leak out from the project. In contrast, support organizations assure them that they are ready to collaborate and deal with the authors honestly.

The result of the Nizhny Novgorod case study from a scientific point of view is a list of factors for further quantitative studies to determine the influence of the most important factors on the activity and development of small innovative companies. Particularly noteworthy are such obstacles as the management and protection of intellectual property, and legislative barriers to innovations.

The findings of the research could assist policy-makers in meeting the needs of small innovative companies and adjusting support programs. Small innovative companies are a driver for economic growth and it is an acute question for many regions how to support and develop this phenomenon. Therefore, it is necessary to eliminate the obstacles to small innovative companies' development. The practical significance of this research for the government is in improvement of the situation in the region by implementing recommendations according to the infrastructure type.



*Financial infrastructure.* The government should facilitate the procedure of obtaining government grants for innovative projects. It's significant to create a seed fund and develop a system to its full operation and interaction with existing innovative infrastructure elements of the Nizhny Novgorod region. The government must co-finance innovative projects together with private investors to reduce the risk for each part.

*Information infrastructure.* It is important to announce ongoing activities in different mass media (advertising on billboards, in business magazines, on the Internet website of the Ministry of supporting small business and the Ministry of industry and innovation, as well as online resources of other innovation infrastructure organizations, putting up posters in universities and business centers). It is necessary to involve large business in such projects as conferences, competitions, summits and other events for small innovative business development.

*Personnel infrastructure.* It is significant for the region to develop and implement new educational programs in higher education institutions for the training of specialists in the field of venture management, marketing, project management, intellectual property protection. Also, it is advisable to carry out joint activities for teams of small innovative enterprises and students from such programs as venture management, innovation management and marketing.

*Industrial and technological infrastructure.* The state should create Joint Use Centers and prototyping centers for manufacturing production test batch. It is important to develop technology transfer centers at universities that would really work and help project goes not only to the Russian market, but also abroad.

Results of the Nizhny Novgorod case study may help other countries to predict the same issues and adapt their policies to possible impediments that their innovative companies may face. Moreover, researchers from other countries can use the results of this research as hypotheses for their study. They don't need to look for what barriers there are in the region, and their purpose is to verify the presence of such obstacles in the studied region.

For the regional government it should be recommended to improve support programs in such aspects as collaboration among participants of innovative infrastructure, launching of the seed financial mechanisms, more educational programs for managers of innovative projects, better provision of access to the information resources, mentorship support programs, and special support for manufacturers.

## Acknowledgements

This study was carried out within The National Research University Higher School of Economics Fund Program in 2013 (Faculty of Management – Nizhny Novgorod).

Contribution of authors. Nadezhda Butryumova is a head of the research project; she developed a design of the study, coordinated the data collection and the data analysis, and wrote the manuscript.

Svetlana Karpycheva carried out a literature review, participated in data collection and analysis, and helped draft the manuscript. Elena Kasyanova participated in data collection and analysis, helped draft the manuscript. Khristina Grisheva participated in data collection and analysis, helped draft the manuscript.

## References

- Aleksandrovsky, S., Butryumova, N., & Nazarov, M. (2011). Barriers to the development of innovative entrepreneurship in the Nizhny Novgorod region. *Financial analytics: problems and solutions*, 46, 21-33.
- Arundel, A. (1997). Enterprise strategies and barriers to innovation. *Innovation Measurement and Policies*, 50, 101-108.
- Baldwin, J., & Lin, Z. (2002). Impediments to advanced technology adoption for Canadian manufacturers. *Research Policy*, 31, 1-18.
- Dezhina, I. (2005). Does Russia need a small high technology business? . *People and work*, 3(3), 53-59.
- Doloreux, D. (2004). Regional Innovation Systems in Canada: A Comparative Study. *Regional Studies*, 38(5), 479-492. doi: 10.1080/0143116042000229267
- Galia, F., & Legros, D. (2004). Complementarities between obstacles to innovation: evidence from France. *Research Policy*, 33(8), 1185-1199. doi: 10.1016/j.respol.2004.06.004
- Geroski, P. (1995). Innovation and Competitive Advantage. *OECD Economics Department Working Papers*, No. 159. doi: 10.1787/344434438114
- The Global Innovation Index 2013. The Local Dynamics of Innovation. (2013). In S. Dutta & B. Lanvin (Eds.): Cornell University, INSEAD, the World Intellectual Property Organization.
- Gokhberg, L. (Ed.). (2014). *The rating of innovation development of the Russian Federation regions* (2 ed.). Moscow: National Research University — Higher School of Economics
- Gorodnikova, N., Gokhberg, L., Kuznetsova, I., Martynova, S., Popova, E., Ratay, T., . . . Fridlyanova, S. (2014). *Indicators of innovation activities: 2014: statistical yearbook* (L. Gokhberg, Y. Kuzminov, K. LAYKAM & O. Fomichev Eds.). Moscow: National Research University Higher School of Economics.
- Gutierrez, J. J., & Correa, P. (2012). Commercialization of Publicly Funded Research and Development (R&D) in Russia. Scaling up the Emergence of Spinoff Companies *Policy Research Working Paper: The World Bank*.
- Hadjimanolis, A. (1999). Barriers to innovation for SMEs in a small less developed country (Cyprus). *Technovation*, 19 561-570.



- Huang, X., & Chi, R. (2013). Innovation in China's high-tech industries: barriers and their impact on innovation performance. *International Journal of Technology Management*, 62(1), 35-55.
- Kazakova, N. A., Nasedkina, T. I., & Frantsuzova, I. I. (2009). Analysis of factors in the formation of innovative models for regional economic development: Russian and international experience. *Management in Russia and abroad*, 3, 56-61.
- Larsson, A. (2004). *Innovation output and barriers to innovation*. Statistics in focus: SCIENCE AND TECHNOLOGY, (KS-NS-04-001-EN-N, THEME 9).
- Madrid-Guijarro, A., Garcia, D., & Van Auken, H. (2009). Barriers to Innovation among Spanish Manufacturing SMEs. *Journal of Small Business Management*, 47(4), 465-488.
- Mancusi, M. L., & Vezzulli, A. (2010). *R&D, Innovation, and Liquidity Constraints*. Paper presented at the 2 nd Conference on corporate R&D (CONCORD - 2010). CORPORATE R&D: AN ENGINE FOR GROWTH, A CHALLENGE FOR EUROPEAN POLICY, Bocconi University, Milano.
- Mohnen, P., & Roller, L.-H. (2005). Complementarities in innovation policy. *European Economic Review*, 49, 1431-1450.
- OECD. (2005). *Oslo Manual. The measurement of scientific and technological activities proposed guidelines for collection and interpreting technology innovation data*.
- OECD. (2013). *OECD Regions at a Glance 2013*. OECD Publishing.
- Piatier, A. (1984). *Barriers to Innovation: A study carried out for the Commission of the European Communities, Directorate-General Information Market and Innovation*: Frances Pinter (Publishers) Ltd.
- Ramos-Vielba, I., & Fernández-Esquinas, M. (2012). Beneath the tip of the iceberg: exploring the multiple forms of university-industry linkages. *Higher Education*, 64(2), 237-265. doi: 10.1007/s10734-011-9491-2
- RVC. (2010). *Innovation by Large Companies in Russia: Mechanisms, Barriers, Perspectives* (pp. 40). Moscow: Russian Venture Company.
- Saavedra, M. (2009). Problemática y desafíos actuales de la vinculación universidad empresa: El caso mexicano. *Actualidad contable FACES*, 12(19), 100-119.
- Savignac, F. (2006). The impact of financial constraints on innovation: evidence from French manufacturing firms. In C. d. E. d. I. Sorbonne (Ed.), *Cahiers de la Maison des Sciences Economiques* (pp. 42). Université Paris1 Panthéon-Sorbonne.
- Scozzi, B., Garavelli, C., & Crowston, K. (2005). Methods for modeling and supporting innovation processes in SMEs. *European Journal of Innovation Management*, 8(1), 120-137. doi: 10.1108/14601060510578619
- Sekaran, U. (2003). *Research Methods for Business: a Skill Building Approach* (4th Edition ed.). New York: John Wiley & Sons, Inc.
- Sharma, P., Nookala, S. B. S., & Sharma, A. (2012). India's National and Regional Innovation Systems: Challenges, Opportunities and Recommendations for Policy Makers. *Industry & Innovation*, 19(6), 517-537. doi: 10.1080/13662716.2012.718878
- Silva, M., Leitao, J., & Raposo, M. (2007). Barriers to Innovation faced by Manufacturing Firms in Portugal: How to overcome it? : Munich Personal RePEc Archive.
- Silvernagel, C., Schultz, R. R., & Moser, S. B. (2009). Student-generated intellectual property: perceptions of ownership by faculty and students. *Journal of Entrepreneurship Education*, 12, 13-33.
- Sivak, R., Caplanova, A., & Hudson, J. (2011). The impact of governance and infrastructure on innovation. *Post-Communist Economies*, 23(02), 203-217. doi: 10.1080/14631377.2011.570050
- Tourigny, D., & Le, C. D. (2004). Impediments to innovation faced by Canadian manufacturing firms. *Economics of Innovation and New Technology*, 13(3), 217-250. doi: 10.1080/10438590410001628387
- Verkhovskaya, O. R., Dorokhina, M. V., & Sergeeva, A. V. (2013). National Report. Global Entrepreneurship monitor. Russia 2013. St. Petersburg: Graduate School of Management, St. Petersburg University.
- Vermeulen, P. A. M. (2005). Uncovering Barriers to Complex Incremental Product Innovation in Small and Medium-Sized Financial Services Firms. *Journal of Small Business Management*, 43(4), 432-452.
- Vrgovic, P., Vidicki, P., Glassman, B., & Walton, A. (2012). Open innovation for SMEs in developing countries – An intermediated communication network model for collaboration beyond obstacles. *Innovation: Management, Policy and practice*, 14(3), 290-302.
- Weigand, J., & Audretsch, D. B. (1999). *Does Science Make a Difference? Investment, Finance and Corporate Governance in German Industries*. CEPR Discussion papers, (2056). London.
- Xie, X. M., Zeng, S. X., & Tam, C. M. (2010). Overcoming barriers to innovation in SMEs in China: A perspective based cooperation network. *Innovation: Management, Policy and practice*, 12(3), 298-310.
- Zeleny, M. (2012). High Technology and Barriers to Innovation: From Globalization to Relocalization. *International Journal of Information Technology & Decision Making*, 11(02), 441-456. doi: 10.1142/s021962201240010x

## Appendix A

### List of respondents

1. NP “Business Angels Association” Start Invest”, Director.
2. Administration of the Nizhny Novgorod Region, Deputy Governor, Deputy Prime Minister of the Nizhny Novgorod region.
3. Nizhny Novgorod Venture Fund, Deputy Director.
4. Innovation and Technology Centre, Lobachevsky State University of Nizhny Novgorod – National Research University, Director.
5. The Institute of Applied Physics of the Russian Academy of Sciences (IAP RAS), Head of innovative program department.
6. Innovation Business Incubator of the Nizhny Novgorod Region, Deputy Director.
7. SarovTechnopark, Head of Investment Department.
8. Nizhny Novgorod Scientific Information Center, Director.
9. Nizhny Novgorod Scientific Information Center, Deputy Director.
10. The Angel Investor Journal, Chief Editor and Publisher.
11. National Research University Higher School of Economics, City of Nizhny Novgorod, Dean of the Advanced Training Department.
12. Lobachevsky State University of Nizhny Novgorod – National Research University, Head of International Business Program EURECA.
13. Youth business community “Koleso”, Executive.
14. The Ministry of Education of the Nizhny Novgorod Region, Deputy Minister.
15. Venture Company “Start Investment”, Director.
16. Nizhny Novgorod State Technical University n.a. R.E. Alekseev (NSTU), Associate Professor.
17. National Research University Higher School of Economics, City of Nizhny Novgorod, Deputy Head of the Center for Entrepreneurship.
18. Marchmont Capital Partners, Founder. Lobachevsky State University of Nizhny Novgorod – National Research University, Vice-rector for Innovations.
19. Business Angels Association “Start Investment”, President. National Research University Higher School of Economics, City of Nizhny Novgorod, Head of Venture Management Department.

# Integrating Technology, Management and Marketing Innovation through Open Innovation Models

*Jaider Vega-Jurado<sup>1</sup>; David Juliao-Esparragoza<sup>1</sup>; Carlos D. Paternina-Arboleda<sup>1</sup>; Milena C. Velez<sup>2</sup>*

**Abstract:** This paper explores, through a company case study, the importance of innovation for the competitive development of a company and how the adoption of an open innovation strategy could be effective to face typical barriers associated with the implementation of such processes. The case analysis shows the importance of the University-Industry relationship and the relevant role that the government plays in fomenting these relationships. Likewise, we point out the value of adopting an integral vision of the innovation process that not only considers its technological dimension (new product development), but also the elements associated to marketing and organizational change practices. The case studied herein exemplifies the systemic character of innovation and the relevance it has for companies, particularly for SME's, to open its innovation strategy and integrate themselves with other actors to leverage its cognitive and financial resources as well as to explore new routes to bring the best of its internal technological capacities.

**Keywords:** Open innovation, technology innovation, innovation in marketing, University-Industry-Government relationship

Submitted: August 30th 2015 / Approved: December 2nd 2015

## Introduction

Innovation is a key factor for economic growth and for enhancing competitiveness in industry. This is why it is not strange that governments, especially in developed countries, have for decades intervened actively in the economy designing and implementing policies that focus on a more dynamic innovation environment. Nowadays, there is consensus on the fact that innovation is a determinant engine to improve economies based on fostering local and country-wide competitiveness.

In the case of Colombia, special interest in fomenting innovation began to enter the political agenda in the early 90's. This started with the government passing Law 29 for Science and Technology and later passing the CONPES policies (National Council of Socio-Economic Policy) 2739 (in 1994) and 2848 (in 1996). These gave the basis for what became known as the National System for Innovation. Within these actions, several instruments were designed to foment innovation in companies. Combine financial support came from direct programs (such as project co-financing, a type of soft credit line), indirect programs (such as fiscal incentives), and the strengthening of government agencies, industry associations, and Non-Government Organizations (NGO's) to improve the relationships among the different stakeholders in the system.

Despite all efforts during the last decades, the Colombian system of innovation is still weak and is not articulated (OCDE 2014). Indicators such as the national expenditure in R&D and key performance indicators, both scientific (publications) and technological (patents), show that the country is still lagging even compared to other countries in the region. Likewise, innovation indicators, derived from the

latest industrial and technological development surveys, prove that there is a very low company dynamism in this field. On average, only a third of the Colombian industrial network have introduced innovations to the market in the last years.

Companies constitute by far the core of any system of innovation. These are the stakeholders called to boost the economy through the development of new goods and services or the implementation of new/improved processes that increase revenue, generate new jobs, and contribute to a greater wellbeing. However, research shows that innovations processes do not develop in isolation. On the contrary, companies tend to interact not only with other companies but also with universities and research centers, with the objective of gaining knowledge and complimentary resources (Fleming, 2001; Helfat, 2006; Laursen y Salter, 2006). As a matter of fact, an approach that has gained attention in the last years and that has been considered by some researchers as the new paradigm in innovation management is the concept of open innovation (Chesbrough, 2003). This concept suggests that companies could and should use not only internal ideas but also the existing knowledge from its environment to develop their innovation processes. The relationship between companies with external stakeholders can turn into the most effective strategy to exploit the internal technological capabilities and develop new products and processes.

In addition to what has been previously exposed, the development of innovation activities is also determined by the existence of an adequate regulatory framework. This is especially true in matters of intellectual property and the start of financial support programs that help minimize the associated risks and costs. It is precisely within this context that the University-Company-Government triad gains

<sup>1</sup> Universidad del Norte- Business School, Barranquilla-Colombia.

<sup>2</sup> Velez, Milena C. Aloe Technology S.A.S

\*Corresponding author: jaiderv@uninorte.edu.co



value as the backbone to generate or drive public policy to promote innovation and to encourage an innovation-driven performance for organizations.

This article explores how the interaction between all the stakeholders previously mentioned (company, university, government) can effectively promote innovation processes and identify the strengths and limitations of some measures that are currently implemented in Colombia related to public intervention. This is accomplished herein through a case study analysis of Aloe Technology S.A.S. Likewise, we attempt to identify some obstacles that Colombian companies face when they take on the challenge of carrying out innovation processes. Finally, we also seek to identify strategic elements that serve as a reference on good practices for other companies with interest in innovation.

In the case study, we begin by looking at the company's initiation and then follow it until the present time. We look at how the company proceeds to systematize innovation activities and to develop an integrated strategy that includes not only technological innovations but also marketing innovations (OECD, 2005). We perform the analysis employing the open innovation approach, and we identify how the strategies that the organization implements comply with the principles highlighted by this paradigm. Throughout the analysis, we study the context and the conditions that favor the development of innovation processes from a more systemic approach, with particular attention to the role of government.

### **Aloe Technology market entry: The Odyssey of the entrepreneurial team**

Entrepreneurship has gained importance in modern economies because of their potential to promote productive transformation processes and revitalize the economy of the territories. In fact, some authors have argued that the world's economy has undergone a transformation that goes from managerial capitalism to entrepreneurial capitalism (Audrestch et al, 2006; Baumol et al, 2007).

In recent years, several studies have analyzed the key factors behind the entrepreneurial activity and their impact on national development. In this field, the widest and broadest research is the Global Entrepreneurship Monitor (GEM), which has been ongoing since 1999 and in its latest version covered about 70 economies. An interesting aspect of this research is that it not only considers the entrepreneurial activity rate (EAR) of a territory, but also qualifies it according to the fundamental motivation that gives rise to entrepreneurship: a) a need for self-employment or b) recognition of an opportunity in the market. In relation to this classification, the results of the latest GEM report showed Colombia with an opportunity entrepreneurship rate of 26.7% compared with 18.1% entrepreneurship activity rate due to necessity (GEM 2013). While it is possible that the answers gathered from the survey contain some bias, one can also see the evidence of a positive behavior in the figures, highlighting a greater boom of ventures that identify market opportunities associated with the product they offer.

Aloe Technology proves the concept of this type of entrepreneurship. This company had its origin in the business vision of five members, three relatives and two outside investors, who had every intention of doing business. The characteristics of these investors include high levels of technical knowledge and experience in developing applied research processes in the industrial sector. One of them, a university professor with an engineering doctoral degree, made an exploratory research on business opportunities associated with the exploitation of natural resources in Colombia's Caribbean region. As a result of that analysis, he identified the existence of a crop that despite having an abundant supply in the region was being underutilized from the industrial point of view. This crop was the Aloe Vera leaf.

Aloe Vera (*Barbadensis* Miller in this case) is a plant with several cosmetic, nutritional, and medicinal properties. It is a stimulant of cell growth, anti-toxic, antimicrobial and it also has astringent, analgesic, and anti-coagulating properties. Today, Aloe Vera is used in various economic sectors and activities. These range from companies that produce raw materials for personal care, cosmetics, and medicinal products, to companies that produce food and beverages.

The initial exploration made by the entrepreneurs showed that there were more than 75 companies that used Aloe Vera as an ingredient to their products and were mainly importing the raw material since there was not enough supply in the country for this demand. This market study was the trigger that motivated the start-up of the company with an initial investment of over US \$300,000.

The entry of the company to the market was foreseen primarily as an extraction and first transformation towards the production of Aloe Vera gel as a raw material (in different concentration levels) for a B2B operational model. At the time, the company had the objective of fulfilling a market share need specializing in raw materials towards the food & beverages and cosmetics industries that used this component as an ingredient of their products.

The company started in 2009 but its manufacturing plant only started operations during the last quarter of 2011. Nevertheless, the optimism once held on the opportunity to gain market share rapidly shifted to a strong realistic scenario in which the demand for pure Aloe Vera gel with high quality grade was not even close to match the initial forecast. This was mainly due to the fact that many of the national companies that claimed the use of Aloe Vera as an ingredient for their products were in reality buying a lesser quality grade Aloe Vera gel. Moreover, this gel was already mixed with glycerin and/or propylene glycol to enhance the percentage of solids they sold in the product. For over 18 months, the company struggled trying to find a breakeven point that did not come. At the end, the entrepreneurs realized that offering a pure raw material for the national market was definitely not going to boost the company and they had to rethink the business.

In addition, the entrepreneurs did not foresee any need to adjust the initial budget and decided to use financial credit lines to fund the operation. This actually created more damage towards the development of the business due to the associated high upfront financial capital costs.

## Innovation: Aloe Technology strategy to rethink itself and compete

With a huge burden ahead, the entrepreneurs understood that the road initially conceived for the business plan was not adequate. They then moved forward with a new process of market exploration to identify real growth opportunities by generating products with more aggregate value. The production of specialty beverages and cosmetics appeared as very promising areas for interesting development. Nevertheless, despite the growth perspective, these sectors also showed strong entry barriers due to the size of competitors and the scale economies these already had in effect.

The entrepreneurs also understood that they had to develop products with a different value to those offered by competitors to enter this market share. Taking advantage of their existing capacity and technology, they decided that the best option was to develop products with a greater content of Aloe Vera. The products were directed towards a more exigent consumer who valued the wonderful natural properties that Aloe Vera provide for medicinal and nutritional use. That is, they decided not to compete directly in markets already captured by current well positioned competitors but rather compete in a more reduced but more specialized market with a higher perceived value from the consumer standpoint.

This assumed, as any other innovation process, great financial and technological challenges for the company. These new products required large R&D expenditure in areas where the company had little to none of the required technical competencies. Likewise, the company was not financially healthy and had no availability to assume the necessary investments for both the product/process R&D phase and the CAPEX/OPEX for the plant enhancement to reach production stage.

The latter situation is not exceptional. On the contrary, this is a most-likely scenario to be faced by companies at the moment they start innovation activities, especially for SME's. For instance, according to the data derived from the National Innovation Survey applied in Colombia (EDIT VI), the greater odds found by companies to proceed with innovation activities are the lack of resources and the lack of qualified personnel<sup>1</sup>. Tackling these barriers constitutes one of the reasons to justify the public intervention towards fomenting business innovation.

In the case of Colombia, the government has for some years implemented programs focused in giving support to the development of innovation activities. These programs have been designed with the goal of fighting the market imperfections (associated to the access to CAPEX), as well as those named System failures (associated to the interaction among stakeholders).

A traditional scheme now in place is the use of co-financing instruments through which companies are granted non-refundable financial resources for R&D and innovation activities, privileging the interaction of these agents with universities and research centers. These types of programs have been traditionally coordinated by Colciencias as the responsible government agency for policy making and the articulation of the National Science, Technology and Innovation System.

One of the company founders, being a university professor and a researcher with the knowledge of the aforementioned instruments, proposed his partners to explore the possibility of applying for these funding opportunities. They therefore approached the academic sector and formulated an R&D project which was then submitted to a call for grant proposals coordinated by Colciencias and that focused on the consolidation of new technology-based business ideas. They obtained funds approved for about US\$140,000.

The support obtained through the public program yielded not only the financial resources needed to face the R&D challenges related to the development of new products, but it also induced a better relationship between the company and the partnering university. This second aspect was fundamental because it allowed the company to undertake activities otherwise impossible to deal with or out of scope for the company. As a result of this project, Aloe Technology developed, at the prototype stage, products to enter into the functional cosmetics market: hydrating lotions in both foam and liquid spray forms.

This perfectly exemplifies one of the open innovation modes proposed by Chesbrough & Bogers (2014) associated to the use and exploitation of external sources of knowledge. Aloe Technology started at that moment a new phase in its business development process. The company positioned innovation as the most strategic asset and developed it with external actors, primarily with academic institutions, as part of its fundamental strategy. The moment they decided to enter markets with more aggregate value products, the company realized the importance of R&D as the basis for their innovation processes and also the importance of opening doors to cooperate with external scientific agents in order to gain new and improved competencies and resources that allowed them to strengthen and leverage their internal capabilities.

University-Industry collaboration has been recognized for decades as an important strategy for business innovation and regional economic development (Etzkowitz, 2003; Laursen & Salter, 2004). In the case of Colombia and especially for technology-based companies such as Aloe Technology, this type of interaction becomes fundamental if we take into account that the R&D capacity resides primarily in academia. While in the USA more than 80% of the researchers work in industry, Colombian universities concentrate more than 90% of re-

(1) 66% of innovative or potentially innovative companies attribute a medium-to-large importance to the lack of resources while 51% recognize lack of qualified personnel as an important obstacle.



searchers. For a technology-based SME to open its innovation strategy so as to integrate the academic sector becomes a key factor to acquire the knowledge it needs for its innovation processes. If, in addition, the government facilitates this interaction, the risk associated with these activities is then reduced therefore generating very strong synergies.

### **From product design to the market: the challenge of consolidating an integral innovation strategy**

As a result of the University-Industry cooperation project, Aloe Technology designed two products with large percentage of Aloe Vera gel to enter the cosmetics market. The new challenge that the company faced was to move from the design phase towards industrial production and commercialization. This demanded again relevant financial resources besides the development of marketing competencies that the company did not have at the time.

The manufacturing facility was originally designed solely for gel extraction, but not for the manufacturing of cosmetics. To build with state-of-the-art technology for this purpose presumed a considerable capital investment which entrepreneurs were averse to assume independently. The solution was to joint venture in a strategic partnership with a well-established cosmetics laboratory with demonstrated experience in new product introduction. In such a way, the company opened its innovation strategy not only to the acquisition of knowledge but also to cooperate with other companies to manufacture the product. Aloe Technology faced both basic dimensions identified by Chesbrough in its open innovation paradigm: the use of external funding and the exploration of new routes to exploit the internal technology capacity and get to the market (Chesbrough, 2003). These are the two strategies that Dahlander and Gahn (2010) named “inbound” and “outbound” innovation strategies.

Besides manufacturing, Aloe Technology had to face another challenge. The initial business model was conceived to be a raw material supplier for companies where Aloe Vera is a component of their product formulation. Therefore, initial customers were other companies where the relationship was based mainly in quality aspects and price. The company never had to constitute a trademark or aggressive consumer marketing campaigns since its end customer was industrial and communications in this case has to be adjusted to B2B commercial trade norms.

The incursion in the cosmetics markets implied the development of commercialization strategies different to those mentioned before. For Aloe Technology, as with many other manufacturing companies, the development of new products is the basis for resilience and innovation is the means to achieve it. However, consolidating as an innovative company involves much more than the development of the technical skills associated with product design. Innovation is important in complementary areas (e.g. processes, marketing) and, in particular, to set forth the management skills for the effective integration of all these aspects in the overall strategy of the company (Tidd and Bessant, 2005). In today's competitive environment, product innovations

are relatively easy to imitate and grant an advantage only in the short term. The long term success of the company in depends on its ability to manage and develop innovations in a systematic way, addressing different components of its business model (product, process, marketing and organization) to respond quickly to customer needs. This ability is much more difficult to imitate by competitors and grants therefore a more durable competitive advantage (Hamel, 2007; Skarzynski, & Gibson, 2008).

The aforementioned aspects were recognized promptly by the company and, building on previous experience, it participated again in a call for grant proposals oriented towards business strengthening. The company submitted a new project of collaborative activities aimed at strengthening the innovation capabilities of the company. In this case, the company paid particular attention to developing marketing innovations that would allow consolidating the new products on the market.

As part of this new Project, the company set up a team that worked together with experts from the partnering university in the area of marketing and innovation management.

From the marketing point of view, the initial problem was the type of product to be offered and the type of market to be reached. The choice was made taking into account the following phases: a) preparation of the strategy (Segmentation, Target Market and Positioning); b) developing the desired product mix, associated with the strengths and opportunities encountered, and c) the development of prototypes to be tested in the target customer segment. These phases came from a structured market research process (Lambin, 2009), which is based on the implementation of product as a result of the elements of value that the consumer perceives (Saura & González 2008). In the first phase, we used secondary sources to verify the markets of high growth potential and to find related products. Likewise we conducted in-depth interviews where we found the type of mental representations of selected products in selected markets. Subsequently, we checked the functional and emotional brand attributes of products (Keller, 2008) and found the core values to identify key market entry points. Finally, Aloe Technology designed prototype products, which were tested in the target consumer market to make final adjustments before sending them to the market.

As a result of the previous marketing exercise, the company identified that the majority of cosmetic products on the market had low concentrations of Aloe Vera and that this factor, recognized by consumers as a relevant concern, could be exploited more intensively. They made two prototype products and performed market tests. For this, the Company chose a customer sample from the market segment under study, whom were given the product to use it so as to receive feedback from them.

Customer reviews allowed the company to make some modifications in both product attributes (aroma) and its presentation (package). Customers associated initial versions of the package with an affordable product that was not associated with the final price and also did

not communicate efficiently about the product advantages over the competition. In fact, during the market test no client mentioned that the product had 60% of aloe as a unique attribute. This is because this aspect was not reflected in neither the product container nor the package - a clear consequence of marketing myopia (Levitt 1960). This allowed us to establish an efficient route correcting some common mistakes made by organizations with a marketing philosophy of product orientation (Lamb et al 2013).

With respect to innovative components, Aloe Technology with the support of the university consultant group carried out the design and implementation of their Innovation Management System. They started from the reformulation of its organizational policy and moved onto the design of the tools needed to manage the different phases of the innovation process. While the company learned the importance of innovation and, as mentioned made significant efforts in this field, the fact is that the development of these activities was not due to a systematic process, but rather the interest and dedication of some of the entrepreneurs. Generating ideas for new products was, until then, based on the vision of the founders. However, it was not a process communicated with the rest of the operational areas of the company. Similarly, there was no clear strategy to stimulate and exploit the creative potential of employees and make an assessment of the ideas with the greatest market potential. Leveraging the accompaniment of academic cooperation, the company began a process of inner transformation that addressed among others the following:

1. The design of a policy and innovation objectives aligned with the business strategy of the company.
2. Creating an organizational structure to support innovation activities of the company both for implementing innovation projects and for management of the system.
3. Designing a system for the provision and distribution of resources for innovation
4. Identification of tools relevant to the development of innovation activities in the business innovation process. This includes the definition of tools to support processes: a) generation, evaluation and selection of ideas, b) managing innovation projects; c) valuation and protection of innovation results.
5. Definition of assessment methods, monitoring, and improving the innovation system.

As a result of this second project of collaborative activities, Aloe Technology identified new channels and strategies to get their product to the end customer. They also developed a system to holistically manage their innovation processes. They considered the technological dimensions, the dimensions of the market, and organizational challenges (OECD, 2005). This system is based on the open innovation paradigm, and it recognizes the need to coordinate with external actors in order to acquire knowledge and complementary skills. It also involves collaboration with other stakeholders to exploit market opportunities. This is relevant since many of the success stories of innovation in Colombia are related to specific product needs and do not obey structured and planned processes (Malaver & Vargas, 2004).

## Conclusions

Open innovation has become a relevant concept for the analysis of business innovation processes. Its importance is, if anything, much greater in the context of emerging countries where companies have few internal capabilities and can hardly advance innovation activities without resorting to collaborating with external agents. In this sense, the analysis of experiences that exemplify the adoption of this strategy and identify key success factors is an aspect of interest from not only an academic point of view but also in the field of business management.

This article examines, through the study of a particular business case, how an organization can reinvent itself and compete by integrating innovation into their business strategy. The analysis highlights the importance for businesses, particularly for small and newly established, to interact with knowledge networks available in their environment in order to access complementary resources and capabilities to develop new products or processes. In the Colombian context, and generally in the context of Latin American countries, universities are key actors in these knowledge networks, and they concentrate most of the R&D capabilities in the region.

University-Industry cooperation becomes therefore a relevant strategy for innovation and its promotion should be a priority line of action in the framework of public policies on science, technology and innovation. The state (government), as discussed in the case study, plays an important role in the revitalization of any system of innovation, designing and implementing instruments to correct market failures and system failures faced by enterprises. A well-designed public instrument not only promotes access of SMEs to financial resources they need to develop innovation activities, but it can also encourage collaboration between different systems' stakeholders.

The Aloe Technology case has also shown the importance of taking a holistic view of innovation processes, combining the development of products and processes to design new marketing channels, new marketing strategies, and even drive changes in the organizational structure. Innovation covers the various functional areas of the company and not always depend on technological developments. In fact, the ability to have an organization that develops complementary innovations to the development of new products is a key to achieve sustainable long-term advantage and to capture the benefits derived from their innovation efforts.

In this sense, the commissioning of public programs to promote technological innovations (new products or processes) is not only relevant but it also strengthens the organization's abilities to systemically manage their innovation processes.

## References

Audretsch, D. B., Keilbach, M. C., & Lehmann, E. E. (2006). *Entrepreneurship and Economic Growth*. New York: Oxford University Press.

- Baumol, W. J., Litan R. E., & Schramm, C. J. (2007). *Good Capitalism, Bad Capitalism*. New Haven: Yale University Press.
- Chesbrough, H. (2003). The era of open innovation. *Sloan Management Review*, Summer, 35–41.
- Chesbrough, H. & Bogers, M. (2014). *Explicating Open Innovation: Clarifying and Emerging Paradigm for Understanding Innovation*. Oxford University Press, pp. 3-28.
- Dahlander, L & Gann, D. (2010) How open is innovation?. *Research Policy* 39. 699–709
- Etzkowitz, H. (2003). Innovation in innovation: The triple helix of university-industry-government relations. *Social science information*, 42(3), 293-337.
- Fleming, L. (2001). Recombinant uncertainty in technological search. *Management Science* 47 (1), 117–132.
- Hamel, Gary. (2008). *El Futuro de la Administración*. Ed. Norma.
- Keller, K. L., Borneville, E. M. J. H., Cantú, R. G. C., & Mondragón, C. (2008). *Administración estratégica de marca branding*. Naucalpan de Juárez: Pearson Educación
- Lamb, C., Hair, J., & McDaniel, C. (2013). *MKTG 7*. Cengage Learning.
- Lambin, J. J., Sicurello, C., & Calabrese, C. M. G. (2009). *Dirección de marketing: gestión estratégica y operativa del mercado*. McGraw-Hill.
- Laursen, K., & Salter, A. (2004). Searching high and low: what types of firms use universities as a source of innovation? *Research Policy*, 33 (8), 1201-1215.
- Laursen, K. & Salter, A. (2006). Open for innovation: The role of openness in explaining innovative performance among UK manufacturing firms. *Strategic Management Journal*, 27, 131–150.
- Levitt, T. (1960). Marketing myopia. *Harvard business review*, 38(4), 24-47.
- Malaver, F., & Vargas, M. (2004). Los procesos de innovación en la industria colombiana: resultados de un estudio de casos. *Cuadernos de administración*, 17(28).
- OECD, (2005). *Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data*. 3<sup>th</sup> Edition.
- OECD (2014). *Reviews of Innovation Policy Colombia/ Preliminary Version*.
- Gil Saura, I., & González Gallarza, M. (2008). La investigación en valor percibido desde el marketing. *Innovar*, 18(31), 9-18.
- Skarzynski, P. & Gibson, R. (2008). *Innovation to the core*. Harvard Business Press.
- Tidd, J., & Bessant J. (2013). *Managing Innovation: Integrating Technological, Market and Organizational Change*. 4<sup>th</sup> Edition. Wiley.

# Open Innovation and Business Model: A Brazilian Company Case Study

Elzo Alves Aranha <sup>\*1</sup>, Neuza Abudd Prado Garcia <sup>2</sup>, Giselle Corrêa <sup>3</sup>

**Abstract:** Open Innovation is increasingly being introduced in international and national organizations for the creation of value. Open innovation is a practical tool, requiring new strategies and decisions from managers for the exploitation of innovative activities. The basic question that this study seeks to answer is linked to the practice of open innovation in connection with the open business model geared towards the creation of value in a Brazilian company. This paper aims to present a case study that illustrates how open innovation offers resources to change the open business model in order to create value for the Brazilian company. The case study method of a company in the sector of pharma-chemical products was used. The results indicate that internal sources of knowledge, external sources of knowledge and accentuate working partnerships were adopted by company as strategies to offer resources to change the open business model in order to create value.

**Keywords:** open innovation; open business model; internal and external sources of knowledge; partnerships.

Submitted: April 15th 2015 / Approved: December 2nd 2015

## 1. Introduction

Open innovation is increasingly being introduced in international and national organizations for the creation of value (Chesbrough & Rosenbloom, 2002; Lee, Olson, & Trimi, 2012; Morgan & Finnegan, 2008; Ndou, Vecchio, & Schina, 2011). The creation and delivery of value through innovation has become the rule for post-modern companies in the context of the market, driven mostly by two forces, complexity and the rate of change (Hatch, 1997). The company can move between a moderately dynamic market and a high speed market (Eisenhardt & Martin, 2000) that requires an ability to integrate, build and re-configure the internal and external capabilities to respond quickly to changes in the market (Teece, Pisano, & Shuen, 1997).

Teece *et al.* (1997) have denominated them as dynamic capabilities, since they refer to a company's ability to identify innovative ways of obtaining a competitive advantage in the market. The quest to introduce innovation drives the company to capture knowledge outside its boundaries, which can be considered as a dynamic capabilities of the company. The stock of information and knowledge captured externally is transferred to the company and is a useful tool for the creation and delivery of value, increasing the growth of the organization, the conquest of new domestic and international markets, and contributing to increased performance and profits. This movement to capture knowledge from outside the company is one of the driving elements in the creation of value for the company, because it makes operation of dynamic capabilities visible, in the sense of understanding and mapping opportunities and threats, grabbing opportunities to maintain competitiveness through the increase, combination, protection and reinvention of the business model (Teece, 2007; Teece *et al.*, 1997).

Innovation as a vector that expands opportunities and performance in the organization, and which promotes changes in the balance of the market, was first analyzed by Schumpeter (1934), who proposed disruptive innovation as a core element of opportunities for companies. According to Schumpeter (1934), it is only through innovation that the company is able to transform the market from a status of equilibrium to a dynamic state, which turns innovation into the main function of the post-modern company, since innovation touches on the trajectory of growth and profits by capturing and delivering value to customers (Drucker, 1985). Tidd, Bessant and Pavitt (2005) proposed the innovation management model as a path to be followed by organizations so as to integrate technological change, market change and organizational change, and they point out that collaboration is one of the basic components of the innovation model. The collaboration with actors external to the firm is essential in the pursuit of new external knowledge. It was Chesbrough (2003a, 2003b; 2003c), however, who questioned the closed innovation model used by organizations, which was based on internal sources of knowledge and unable to accelerate the creation and delivery of value, and also of performance and profit. The open innovation proposal defends that knowledge coming from external sources at the same level as knowledge from internal sources, intellectual property focused on market sales, company outputs focused on the external market and the business model are central to the company (Chesbrough, 2006; West, Salter, Vanhaverbeke, & Chesbrough, 2014).

The growing and vast international academic production on open innovation demonstrates an increasing international interest in investigating new models, practices, approaches and tools for organizations. Nevertheless, the vast majority of articles on open innovation still have unanswered questions. Among these components of reflec-

1,3 Production Engineering and Management Institute, Federal University of Itajubá, Itajubá, Minas Gerais, Brazil,

2 Nove de Julho University, São Paulo, Brazil

\*Corresponding author: eaaranha@unifei.edu.br





tive elements, three groups of questions stand out that deserve to be investigated. First, there are the issues related to the understanding of the importance of open innovation in high-technology industries; the second set of issues is linked to the study of how companies implement innovation in practice (Chiaroni, Chiesa, & Frattini, 2011; Ebersberger, Bloch, Herstad, & Van de Velde, 2012). At the same time the reflections by Mortara and Minshall (2011) gain relevance, who were emphatic in emphasizing the need for the expansion of research on the way in which companies implement open innovation in an attempt to contribute to the fulfillment of this gap. Their study of 43 firms in different sectors looks at how companies move from the practice of closed innovation toward open innovation (Mortara & Minshall, 2011).

The third group of issues is connected with the implementation of the open innovation practice in conjunction with the implementation of the open business model, which is geared toward the creation of value. In the literature, there are studies that seek to analyze business models and open innovation, open innovation strategies with dimensions of the business model (Saebi & Foss, 2014), open innovation and dynamic business models (Gay, 2014) and open innovation and open business models (Frankenberger, Wiblen, & Gassman, 2014; Weiblen, 2014). However, there are few articles that analyze the connections between open innovation and the business model and their influence on the value creation process. By stating that open innovation has the business model at its heart and that it is essential for the creation of value and profit through technology (Chesbrough, 2003b), a question emerges regarding the about practices or strategies, supported by the same open innovations adopted in companies and connections with the generation of benefits and improve the company performance. However, for the capture of internal and external knowledge, and concomitantly with the development of partnerships arising from open innovation and open business models, would they contribute to the creation of value in Brazilian companies? The investigations in this direction will bring new support for the debate about future directions.

The basic question that this study seeks to answer is linked to the practice of open innovation in connection with the open business model geared towards the creation of value in a Brazilian company. It intends to answer the following question: how should the acquisition of internal knowledge, the acquisition of external knowledge and partnership development, supported by open innovation, provide resources to change the open business model in order to create value for the Brazilian company? The answer to this basic question will contribute to fill the gap pointed out earlier, offering analyses and reflections on the connections between open innovation, the open business model and value creation.

This paper aims to present a case study that illustrates how open innovation offers resources to change the open business model in order to create value for the Brazilian company. In particular, it intends to analyze how the acquisition of internal knowledge, and the acquisition of external knowledge and partnership development, supported by open innovation, should provide resources to change the open business model in order to create value for the Brazilian company. The case study of a company in the sector of pharma-chemical products demonstrates that open innovation (acquisition of internal knowledge, acquisition of external knowledge and partnership development) paves the way for the reinvention of the business model and promotes value creation.

## 2. Methods and Techniques

The reflexive methodology (Alvesson & Sköldbberg, 2000) guided the analysis of the international literature on open innovation, open business models and value creation. The study was exploratory and qualitative. Three steps were adopted for the development of this study. In the first step, searches of academic articles were carried out in the CAPES portal using the search-by-subject option. First, the search results for the terms open innovation, open business model and value creation were mapped. Those articles were selected that connected open innovation with open business models and value creation. For open business models, the article by Weiblen (2014) and Frankenberger *et. al.* (2014) was selected, which seek to establish a distinction between open innovation, open business models and business models. For value creation, attention was focused on the studies by Anderson, Narus and Narayandas (2009).

In the second step, the framework of analysis was designed, identifying the independent and dependent variables according to the framework of analysis presented in figure 1 (Calia, Guerrini, & Moura, 2007). Then, the important elements in the literature on open innovation, open business models and value creation were identified. In open innovation, the ways in which the processes for the acquisition of internal knowledge, in parallel with external knowledge and partnerships, offer resources for changing the open business model and allow for the creation of value. The business model was analyzed based on open innovation and value creation.

In the third step, information was gathered on the company's website and other printed and electronic media. The independent variables (search for external knowledge, search for internal knowledge and relationships) that offer resources for the dependent variable (value creation) through the open business model, were analyzed. According to Yin (2005), a case study presents the main research question and the sources of information that contribute to answering this research question.



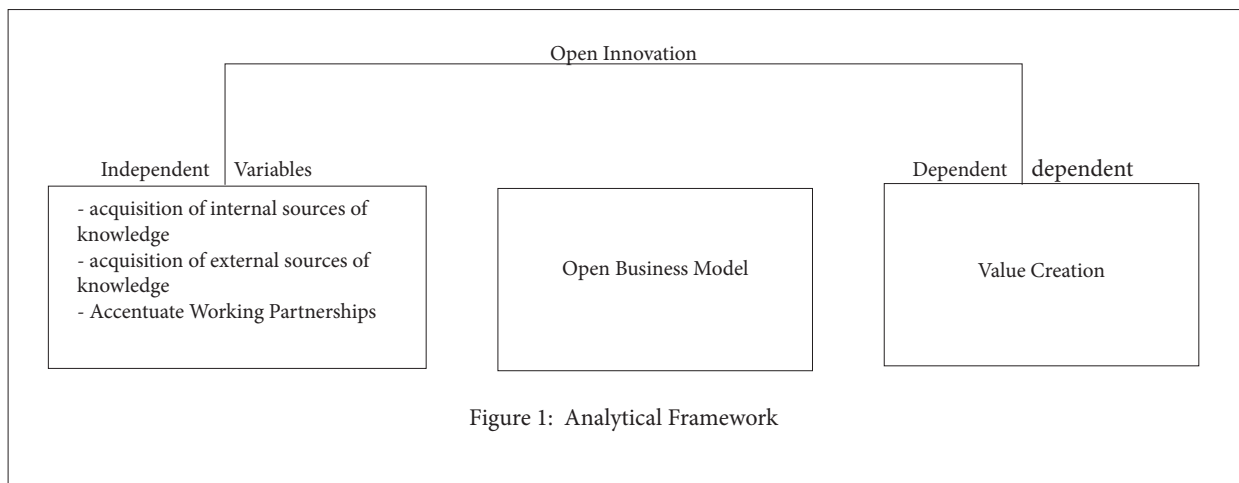


Figure 1: Analytical Framework

### 3. Literature Review

#### 3.1 Open Innovation

Chesbrough (2003a) established the first distinction between open and closed innovation by highlighting that innovation was not inducing the creation of value or increasing profits for companies. According to Chesbrough (2003a), the new era of open innovation is based on the principles of: acquisition of external knowledge, acquisition of internal knowledge, business models and outflows. Acquisition of external knowledge is given its rightful place, at the same level and balanced with internal knowledge. In addition, Chesbrough (2003a; 2003b; 2003c) states that open innovation must be rooted in the notion that research carried out outside the company may enable the generation of value for the company and its partners. Open innovation is a practical tool, requiring new strategies and decisions from managers for the exploitation of innovative activities (Huizingh, 2011). Since it's a practical tool, innovation requires new strategies and decisions from managers for the exploration of innovative activities, improving the flow of external knowledge and information inputs and transforming them into results that improve the company's profit (Huizingh, 2011). Given that open innovation is a management practice tool, it refers to the arena of confrontation between open and closed innovation, the input and output activities of innovation processes and the distinction between processes and results (Huizingh, 2011).

Pressured by moderately dynamic, but also very dynamic and high speed markets, the company may adopt open innovation, considering its dynamic capabilities to identify new ways of obtaining a competitive advantage, analyzing both its strengths and weaknesses and threats and opportunities (Eisenhardt & Martin, 2000; Teece *et al.*, 1997). In closed innovation, the company seeks to increase its competitive advantage by introducing innovations with resources generated within the company, while open innovation contributes to increasing competitive advantage by seeking knowledge and technologies external to the company. Open innovation involves three essential aspects: (i) acquisition of internal sources of knowledge; (ii) acquisition of external sources of knowledge; (iii) accentuate working relationships.

#### 3.1.1 Internal Sources of Knowledge

Companies have various reasons to adopt the practice of open innovation. A study conducted by Van de Vrande, De Jong, Vanhaverbeke and De Rochemont (2009) with 605 micro and small innovative Dutch companies pointed out the main reasons that lead companies to adopt open innovation practices. The main reasons include the alignment of competencies with the company's activities, the improvement of the innovation process, integrating it with the market, the integration of new technologies, the development of new markets and customers, and the increase in market share. These reasons may not be achieved when the company adopts a closed model of innovation by itself. These reasons lead the company to adopt tools that allow for the assessment of internal resources.

Barney (1991) argues that tangible and intangible resources of the firm, such as technical knowledge, equipment, people and capital, can generate value for third parties and sustain a competitive advantage. This perspective that focuses on an internal outlook on the firm's resources is insufficient to maintain the company on course in the search for a competitive advantage. The internal resources of the firm need to go through a test to identify their ability to generate value for customers and partners. The test is carried out with the main competitors, considering whether their imitability, durability, appropriability, substitutability and superior competitiveness as well as their competitors are found in an environment external to the firm (Anderson *et al.*, 2009). Another crucial point is whether the tests of the resources will enable the analysis of strengths and weaknesses compared to the main competitors.

The acquisition of internal sources of knowledge only contributes to value creation and the increase in the company's profit when it is compared with the resources of external competitors (Anderson *et al.*, 2009). Companies implement various strategies to leverage their internal knowledge, such as the licensing of intellectual property developed internally and the involvement of employees in research & development (R&D) (Van de Vrande *et al.*, 2009). However, even if the licensing of internally developed technology to another company may be an important strategic benefit that generates revenues for the

company and represents the sale of residual knowledge, it may also prove restrictive and compromise the performance and profit generation of the company (Lichtenthaler, 2010).

### 3.1.2 External Sources of Knowledge

Teece (2007) emphasizes that dynamic capabilities are rooted in the acquisition of resources external to the firm, in such a way that it may understand and map its opportunities and threats, and seize the opportunities to maintain competitiveness by increasing, combining, protecting and reinventing its business model (Teece, 2007; Teece *et al.*, 1997). The acquisition of knowledge external to the firm occurs as a result of the close relationship with the customer, the development of networks of relationship, external participations, outsourcing of R&D and it may bring intellectual property licenses to the company (Young, Hewitt-Dundas, & Roper, 2008).

External participations are represented by partnerships and collaborations with external companies and organizations in order to develop projects of mutual interest. The acquisition of external knowledge involves a continuous effort by the company (Chen, Chen, & Vanhaverbeke, 2011). Porter and Newman (2011) state that the knowledge from R&D obtained from outside the company involves a set of steps that involve a literature review, the characterization of the research profile, the mining of technology, the discovery of structured knowledge, and discovery based on the literature. The external knowledge acquisition process also involves the search for technologies, which should be chosen and analyzed regarding their main applications and features, and their fit to the needs, desires and demands of the market (Tickle, Adebajo, & Michaelides, 2011).

### 3.1.3 Accentuate Working Partnerships

Anderson *et al.* (2009) state that companies can develop relationships at three levels. The transactional level, which only involves transactions of basic products with a focus on prices. The collaborative level, which involves a mutual interest in the development of solutions, products, services, technologies and processes in various sectors for a variety of purposes. In the collaborative level, the company can move up to the level of partnership, developing strong partnerships in order to establish economic, social, service, technical and cost reduction benefits, and to increase the value added of its operations.

Relationships develop inside business networks that consist of a set of two or more companies that are connected through mutual interests. In open innovation, business relationships and networks in the external environment are strategic for the survival of the company. Knudsen and Mortensen (2011) highlight that the most important external partners in new product development projects are suppliers, customers, universities and research centers, consultants and competitors.

These relationships develop through people and multiple leaders, who organize the business networks and innovation community (Klerkx & Aarts, 2013). In new projects that involve the development of solutions for customers, a strong interaction between the parties, with the intensive sharing of knowledge and communications with the defini-

tion of technology transfer mechanisms, has become essential (Hsieh & Tidd, 2012). However, small businesses involve themselves less in R&D collaboration processes than medium-sized enterprises (Chiaroni *et al.*, 2011).

### 3.2 The Open Business Model

Weiblen (2014) emphasizes that Chesbrough (2003a) associates the open business model with open innovation, highlighting that the pursuit to accelerate internal innovation in the firm is obtained through the development of an environment of collaboration and partnership with institutions in research and development (R&D) in order to develop and commercialize intellectual property (IP) and create economic value. According to Weiblen (2014) this notion in which the open business model intrinsically associates the design or architecture of the value creation, acquisition and delivery mechanisms through open innovation with R&D, is restricted and limited. Based on the analysis of various academic articles, Weiblen (2014) manages to counter this notion, Chesbrough's position, extracting the main elements of the open business model, in addition to narrowing its scope and purpose. According to Weiblen (2014), the term 'openness' in open business models is grounded on the logic of the firm's collaboration with its ecosystem. This collaboration is very pronounced and guides the entire design of the firm's representation model, in which strategic decisions to collaborate with the ecosystem are focused on the creation and delivery of value (Frankenberger *et al.*, 2014).

According to Weiblen (2014), the open business model is a subclass of business models in which collaboration plays a central role in order to create and capture value for the company. The strong collaboration of the firm with the other partners of the ecosystem involves not only R&D institutions or transactions, but the partnership modality. A partnership seeks to lower total costs or to increase value over time so as to achieve mutual benefits through economic, technical, social and service benefits arising from the use of the company's proprietary platform by small partners to create value for the customer (Anderson *et al.*, 2009). Lowering total costs or increasing value over time to achieve mutual benefits is associated with the co-creation process between the firm and its ecosystem (Anderson *et al.*, 2009). Collaboration, therefore, plays a key role in the open business model, providing a favorable environment for co-creation between the firm and its ecosystem through the use of mutual resources which are focused on the creation and delivery of value (Weiblen, 2014).

Calia *et al.* (2007) investigated the innovation network in connections with business model identifying the independent variables (relationship structures, innovation typology and innovation network dynamic) and dependent variables (business internationalization and company growth) in Brazilian metallurgy company. Calia *et al.* (2007) adopted business model framework (Morris, Schindehutte, & Allen, 2005) to describe the metallurgy company's business model in connections with innovation network. However, the present study adopts three different kind of business model framework (Chesbrough & Rosembaum, 2002; Morris *et al.*, 2005; Osterwalder, Pigneur, & Tucci, 2005). The conceptual framework of the open busi-

ness models proposed by Chesbrough and Rosembaum (2002), Osterwalder *et al.* (2005), and Morris *et al.* (2005) each contain basic components that structure and characterize each one of these models. The models differ in terms of basic components. However, there are some basic components that are common and present in all models. The answers to some questions are crucial to see which basic component are common to the three models: (1) how does the company create value? (2) For whom does the company create value? (3) What are the sources of external and internal knowledge for the creation of value? (4) How does the company develop partnerships to create value? These questions will be answered in the case study analysis.

### 3.3 Value Creation

The concept of value used in this study comes from the field of Marketing. Anderson *et al.* (2009) describe value as the sum of all the economic, technical, service and social benefits that a customer receives in exchange for a price he pays for a market offer. According to Anderson *et al.* (2009) the value received by the customer needs to be compared and be superior to the value delivered by the best alternative offered by a competitor. This concept of value is directly associated with the customer. However, the concept of shareholder value has been used by executives in order to evaluate business performance. Shareholder value represents the economic return arising from the implemented decisions and strategies that exceeds the capital costs employed in the business (Anderson *et al.*, 2009). Value creation is directly associated with the customer and the company.

Low (2000) proposes a model that involves nine non-financial performance categories that determine the creation of value. The value creation index represents the sum of all main intangible assets that the company can evaluate. The nine categories of the model are: (1) innovation, (2) quality, (3) customer relations, (4) management capabilities, (5) alliances, (6) technology, (7) brand value, (8) employee relations, and (9) environmental and community aspects. These categories enable the measurement of the firm's intangible assets, providing information on the company's performance. Morgan and Finnegan (2008) state that the company creates value for the company itself through efficiency in business, the availability and sharing of knowledge with the community and customers, and the development of solutions for these actors. The new products meet the needs, desires and requirements of the customers. The company creates value for the customer when it increase the level of satisfaction and increases collaboration, participation and the delivery of benefits.

## 4. Case Study

### 4.1 Case Study Protocol

The literature review enabled the identification of the main elements involved in open innovation: (i) acquisition of internal sources of knowledge, (ii) acquisition of external sources of knowledge and (iii) relationships, since these elements are represented in the cognitive device, called the open business model, seeking the creation of value. Figure 1 sets out the framework of this analysis in independent vari-

ables (search for external knowledge, search for internal knowledge and relationships), which offer resources to the open business model which affect the dependent variable (value creation).

The case study seeks to illustrate how open innovation offers resources to change the open business model in order to create value for the Brazilian company. In particular, it intends to analyze how the acquisition of internal knowledge, the acquisition of external knowledge and partnership development, supported by open innovation, provide resources to change the open business model in order to create value. The case study seeks to answer the following question: how do the acquisition of internal knowledge, the acquisition of external knowledge and partnership development, supported by open innovation, provide resources to change the open business model in order to create value for the Brazilian company? The information on the company in the pharmaceutical sector was gathered from the company's website, and from newspapers and magazines. The official name of the company will not be mentioned in this study. The name Alpha was adopted to designate the case study company.

### 4.2 The Alpha Company

The Alpha Laboratory is a Pharmaceutical, Pharmaceutical, Biotechnology, Research, Development and Innovation complex with 100% Brazilian capital. The Alpha was founded in the beginning of the 1970s as a nursing home in the city located in the heartland of São Paulo State. To meet the internal demand for medication, the four founding physicians of the nursing home started a laboratory with a production capacity exceeding the internal demand for consumption. This surplus was then sold. Innovation was at the heart of Alpha since its founding. In 1976, it developed Haloperidol, an anti-psychotic that was being produced through a monopoly of a multinational company.

The company operates in the following business sectors: (i) hospitals, with products used in the environments of 95% of Brazilian hospitals; (ii) pharmacies, with products sold in more than 40 thousand pharmacies; (iii) *corporis*, involving products for dermatology, aesthetics and derma-cosmetics; (iv) biological products focused exclusively on radiology, hemodialysis, surgery, oncology, and dentistry clinics and with asepsis brushes for the hands of surgeons; (v) generics, with products and medication intended for: psychiatry, neurology, cardiology, gynecology, ophthalmology, and dermatology, among others. The company develops products for the business areas of anesthesia, erectile dysfunction, AIDS, central nervous system (bipolar disorders, schizophrenia, depression), pain and inflammation, dermatology and aesthetics. The company sells its finished products and raw materials to more than 30 countries. Its main markets are Latin America, Asia, Africa and the Middle East. Its main products are anesthetics and its adjuvants, analgesics, psychiatric products and antiretroviral drugs.

The pharmaceutical department totals more than R\$ 160 million in investments, with 35 thousand square meters of constructed area and a fully automated plant, offering safety for all types of drugs. The pharmaceutical departments also counts with another plant of 16 thousand square meters for the production of solid, semi-solid, oral,

injectable and eye drop drugs. Its second department, the center for research, development and innovation, has invested in the order of R\$ 30 million and was opened in 2009. There are currently 29 projects in progress, 14 of which are incremental innovations and 15 radical innovations that are unprecedented in the world. The center is made up of 105 scientists and 25 highly specialized technicians. The company currently has more than 76 patents until the end of 2014. Until February 2014, the lab had 152 patent applications. The pharmaceutical division was formed in 1983 and at the beginning of 1988 a massive investment was made in the research, development and innovation of active pharmaceutical inputs of high value-added that didn't exist in the national market or that were listed as inputs subject to import quota.

Currently, the Laboratory has more than 25 strategic partnerships with universities, research institutes and government agencies. There are more than 11 partnerships with universities. In 2013, Alpha had R\$ 1.4 billion in revenues, which places the company among its major competitors in industry sector. The reinvention of the business model was the main factor for its growth. The partnership with research institutes, whether from universities or not, governments, development promotion agencies and health professionals, has always been on the strategic agenda of the company.

#### 4.3 Case Analysis

The acquisition of internal sources of knowledge, external sources of knowledge and relationships were adopted as strategies by Alpha to pave the way for the company's growth, internationalization of its market and value creation. The inauguration of the center for research, development and innovation in 2009 reinvented Alpha's business model. The strong partnerships with universities enabled the acquisition of high quality sources of knowledge, contributing to the development of new products and new markets.

Considering the main common components of the conceptual frameworks of open business models proposed by Chesbrough and Rosembaum (2002), Osterwalder *et. al.* (2005), and Morris *et. al.* (2005), the next step is to describe the business model of Alpha. The description of the main common basic components of the business model (Calia *et. al.*, 2007) will enable the illustration of how the acquisition of internal knowledge, the acquisition of external knowledge and partnership development, supported by open innovation, provide resources to change the open business model in order to create value. This description is linked to the following questions:

- (1) how does the company create value? - Alpha creates value by delivering high-quality products that require research, development and innovation. The creation of value was intensified based on the deployment of the center for the development of research and innovation.
- (2) For whom does the company create value? - The company creates value for customers in Brazil and in more than 30 countries, delivering high-quality and knowledge and technology intensive raw materials and finished products.

(3) What are the sources of external and internal knowledge for the creation of value? - The acquisition of opportunities in the external environment of the company enables the extraction of external knowledge, which passes to the internal environment of the company, increasing value creation. On the other hand, the creation of the center for research, development and innovation intensified the expansion process with the participation of 105 scientists and 25 highly skilled technicians. The company currently has more than 76 patents until the end of 2014. Until February 2014, the lab had 152 patent applications filed.

(4) How does the company develop partnerships to create value? Currently, the Laboratory has more than 25 strategic partnerships with universities, research institutes and government agencies. There are more than 11 partnerships with universities. The projects developed with universities are synchronized with the center for research, development and innovation. The generation of innovative knowledge through patents enhance the creation of value.

#### 5. Findings

According to analytical framework presented in figure 1 (i) acquisition of internal sources of knowledge, (ii) acquisition of external sources of knowledge and (iii) accentuate working relationships are important elements, supported by open innovation, identified in the literature review. Based on case analysis (multiples sources of information of Alpha company) three important factors provide resources to change the open business model in order to create value for the Alpha Brazilian company. The exploratory and qualitative study demonstrated how independent variables can offer resources to the open business model which affect the dependent variable.

The study identified the connections between open innovation, open business model and value creation. In particular, it illustrated that Alpha company adopted strategies based on acquisition of internal sources of knowledge, acquisition of external sources of knowledge and accentuate working relationships from open innovation to reinvent business model and increase value creating to the customers. The Alpha company adopted open business model. The quality of the causality relations were anchored in: (i) Open innovation literature review; (ii) Open business model concept (Frankenberger *et. al.*, 2014; Weiblen, 2014) and main common components of the conceptual frameworks of open business models proposed by Chesbrough and Rosembaum (2002), Osterwalder *et. al.* (2005), and Morris *et. al.* (2005); (iii) Value creation concept (Anderson *et. al.*, 2009). However, the present study was qualitative and findings need to be validated in future studies by quantitative analysis (Calia *et. al.*, 2007).

#### 6. Concluding Remarks

When thinking about innovation, one should first reflect on the "Post-Industrial Society" scenario, a term coined by Alain Touraine (1997), that is characterized by the replacement of an economy based on industry by another in which the service sector has a greater participation. Touraine was one of the main intellectuals to take a critical



look at the privatization, capital internationalization, economic liberalism and social change processes. This theorist considers that the fragmentation of the city and of the subject brings other strategies to the fore, which not only imply social democratic inclusion, but also possibilities for resistance and overcoming challenges. As such, he recovers the individual, who should not remain unconnected from the subject. For this duality is indicative of a rupture, because it puts the subject outside of history, with this overlap having significant implications for the historical narrative. And in an attempt to look forward to impasses caused by globalization, which are leading to an axis of domination between the owners of capital and the marginalization of those who don't have capital, the way that is pointed out implies a re-thinking of these new media forms of local and global space in a common dimension of humanitarian goals and objectives, seeking more growth and social progress. In this dimension, the perspective is rekindled of intellectual capital as one of these big challenges that companies should face if they are committed to advances and new directions. The question is then, how does one promote a reflexive perspective so that the actors in day-to-day activities may have an understanding *in* and *of* the empirical-inductive field, with a symbolic outlook? What would be the determinant conditions that would enable a mediation between thought and language? Would they exist based on facilitating situations? Does the act of curiosity and bewilderment in relation to the object to be observed imply an act of reading? But in which dimension? What is its nature?

Open innovation in this post-modern and post-contemporary context is increasingly being introduced in international and national organizations for the creation of value. The creation and delivery of value through open innovation has become the rule for post-modern companies in the context of the market, driven mostly by two forces, complexity and the rate of change. The company can move between a moderately dynamic market and a high speed market that requires an ability to integrate, build and re-configure the internal and external capabilities to respond quickly to changes in the market.

Based on the case study, one can infer that the acquisition of internal sources of knowledge, external sources of knowledge and relationships were adopted as strategies by Alpha to pave the way for the company's growth, internationalization of its market and value creation. The inauguration of the center for research, development and innovation in 2009 reinvented Alpha's business model. The strong partnerships with universities enabled the acquisition of high quality sources of knowledge, contributing to the development of new products and new markets. As such, it will be necessary to promote new contours for inventive-innovative processes.

## References

- Alvesson, M., & Sköldborg, K. (2000). *Reflexive Methodology: new vistas for qualitative research*. London: Sage.
- Anderson, J., Narus, J., & Narayandas, D. (2009). *Business market management: understanding, creating, and delivering value*. 3rd. edition. Upper Saddle River, New Jersey: Prentice Hall.
- Barney, J. B. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99-120. doi: 10.1177/014920639101700108
- Calia, R.G., Guerrini, F.M., & Moura, G.L. (2007). Innovation networks: From technological development to business model reconfiguration. *Technovation*, 27(8), 426-432. <http://dx.doi.org/10.1016/j.technovation.2006.08.003>
- Chen, J., Chen, Y., & Vanhaverbeke, W. (2011). The influence of scope, depth, and orientation of external technology sources on the innovative performances of Chinese firms. *Technovation*, 31(8), 362-373. <http://dx.doi.org/10.1016/j.technovation.2011.03.002>
- Chesbrough, H., & Rosenbloom, R.S. (2002). The role of the business model in capturing value from innovation: Evidence from Xerox Corporations' technology spin-off companies. *Industrial and Corporate Change*, 11(3), 529-555. <http://dx.doi.org/10.1093/icc/11.3.529>
- Chesbrough, H. (2003a). The era of open innovation. *MIT Sloan Management Review*, 44(3), 35-41.
- Chesbrough, H. (2003b). *Open innovation: the new imperative for creating and profiting from technology*. Boston, MA: Harvard Business School Press.
- Chesbrough, H. (2003c). The logic of open innovation: Managing intellectual property. *California Management Review*, 45(3), 33-58. <http://dx.doi.org/10.2307/41166175>
- Chesbrough, H. (2006). Open Innovation: A new paradigm for understanding industrial innovation. In Chesbrough, H., Vanhaverbeke, W., & West, J. (eds.), *Open Innovation: Researching a New Paradigm* (pp.1-12). Oxford: University Press.
- Chiaroni, D., Chiesa, V., & Frattini, F. (2011). The Open Innovation Journal: How firms dynamically implement emerging innovation management paradigm. *Technovation*, 31(1), 34-43. <http://dx.doi.org/10.1016/j.technovation.2009.08.007>
- Drucker, P. F. (1985). *Innovation and Entrepreneurship*. New York, NY: HarperCollins Publishers.
- Eisenhardt, K.M., & Martin, J. (2000). Dynamic capabilities: what are they? *Strategic Management Journal*, 21(10-11), 1105-1121. [http://dx.doi.org/10.1002/1097-0266\(200010/11\)21:10/11<1105::aid-smj133>3.0.co;2-e](http://dx.doi.org/10.1002/1097-0266(200010/11)21:10/11<1105::aid-smj133>3.0.co;2-e)
- Ebersberger, B., Bloch, C., Herstad, S., & Van de Velde, E. (2012). Open innovation practices and their effect on innovation performance. *International Journal of Innovation and Technology Management*, 9(6), p.1250040-1250040-23. <http://dx.doi.org/10.1142/s021987701250040x>
- Frankenberger, K., Wiblen, T., & Gassman, O. (2014). The antecedents of open business models: an exploratory study of incumbents firms. *R&D Management*, 44(2), 173-188. <http://dx.doi.org/10.1111/radm.12040>



- Gay, B. (2014). Open innovation, networking, and business model dynamics: the two sides. *Journal of Innovation and Entrepreneurship*, 3(2), 1-20. <http://dx.doi.org/10.1186/2192-5372-3-2>
- Hatch, M. (1997). *Organization Theory: Modern, Symbolic, and Postmodern Perspectives*. Oxford: Oxford Press.
- Hsieh, K., & Tidd, J. (2012). Open versus close new service development: the influences of project novelty. *Technovation*, 32(11), 600-608. <http://dx.doi.org/10.1016/j.technovation.2012.07.002>
- Huizingh, E.K.R.E. (2011). Open Innovation: State of Art and Future Perspective. *Technovation*, 31(1), 2-9. <http://dx.doi.org/10.1016/j.technovation.2010.10.002>
- Klerkx, L., & Aarts, N. (2013). The interactions of multiple champions in orchestrating innovation networks: Conflicts and complementarities. *Technovation*, 33(6-7), 193-210. <http://dx.doi.org/10.1016/j.technovation.2013.03.002>
- Knudsen, M.P., & Mortensen, T.B. (2011). Some immediate - but negative - effects of openness on product development performance. *Technovation*, 31(1), 54-64. <http://dx.doi.org/10.1016/j.technovation.2010.07.002>
- Lee, S.M., Olson, D.L., & Trimi, S. (2012). Innovative collaboration for value creating. *Organizational Dynamics*, 41(1), 7-12. <http://dx.doi.org/10.1016/j.orgdyn.2011.12.002>
- Lichtenthaler, U. (2010). Technology Exploitation in the context of open innovation: Finding the 'right' job for your technology. *Technovation*, 30(7-8), 429-435. <http://dx.doi.org/10.1016/j.technovation.2010.04.001>
- Low, J. (2000). The value creation index. *Journal of Intellectual Capital*, 1(3), 252-262. <http://dx.doi.org/10.1108/14691930010377919>
- Ndou, V., Vecchio, P.D., & Schina, L. (2011). Open innovation networks: the role of innovative marketplaces for small and medium enterprises' value creation. *International Journal of Innovation and Technology Management*, 8(3), 437-453. <http://dx.doi.org/10.1142/s0219877011002404>
- Morgan, L., & Finnegan, P. (2008). Deciding on open innovation: an exploration of how firms create and capture value with open source software. In León, G., Bernados, A., Casar, J., Kautz, K., & DeGross, J. (Eds.), *Open IT-Based Innovation: Moving Towards Cooperative IT Transfer and knowledge Diffusion* (229-246). New York, NY: Springer.
- Mortara, L., & Minshall, T. (2011). How do large multinational companies implement open innovation. *Technovation*, 31(10-11), 586-597. <http://dx.doi.org/10.1016/j.technovation.2011.05.002>
- Morris, M., Schindehutte, M., & Allen, J. (2005). The entrepreneur's business model: Toward a unified perspective. *Journal of Business Research*, 58(6), 726-735. <http://dx.doi.org/10.1016/j.jbusres.2003.11.001>
- Osterwalder, A., Pigneur, Y., & Tucci, C.L. (2005). Clarifying business models: Origins, present, and future of the concept. *Communications of the Association for Information Systems*, 16(1), 1-25. Retrieved from <http://aisel.aisnet.org/cais/vol16/iss1/1/>
- Porter, A.L., & Newman, N.C. (2011). Mining External R&D. *Technovation*, 31(4), 171-176. <http://dx.doi.org/10.1016/j.technovation.2011.01.001>
- Saebi, T., & Foss, N. (2014). Business models for open innovation: Matching heterogeneous open innovation strategies with business model dimensions. *European Management Journal*, 33(3), 201-213. <http://dx.doi.org/10.1016/j.emj.2014.11.002>
- Shumpeter, J. (1934). *The Theory of Economic Development. An inquiry into profits, capital, credit, interest, and the business cycle*. Cambridge, MA: Harvard University Press.
- Teece, D. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319-1350. <http://dx.doi.org/10.1002/smj.640>
- Teece, D., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18 (7), 509-533. [http://dx.doi.org/10.1002/\(sici\)1097-0266\(199708\)18:7<509::aid-smj882>3.0.co;2-z](http://dx.doi.org/10.1002/(sici)1097-0266(199708)18:7<509::aid-smj882>3.0.co;2-z)
- Tickle, M., Adebajo, D., & Michaelides, Z. (2011). Developmental approaches to B2B virtual communities. *Technovation*, 31(7), 296-308. <http://dx.doi.org/10.1016/j.technovation.2011.04.002>
- Tidd, J., Bessant, J., & Pavitt, K. (2005). *Managing innovation: integrating technological, market and organizational change*. West Sussex: John Wiley & Sons.
- Touraine, A. (1997). *Crítica da Modernidade*. Petrópolis, RJ: Vozes.
- Van de Vrande, V., De Jong, J.P.J., Vanhaverbeke, W., & De Rochemont, M. (2009). Open Innovation in SMEs: Trends, motives and management challenges. *Technovation*, 29(6-7), 423-437. <http://dx.doi.org/10.1016/j.technovation.2008.10.001>
- Weiblen, T. (2014). The open business model: understanding an emergent concept. *Journal of Multi Business Model Innovation and Technology*, 2(1), 35-66. DOI:10.13052/jmbmit2245-456X.212
- West, J., Salter, A., Vanhaverbeke, W., & Chesbrough, H. (2014). Open innovation: the next decade. *Research Policy*, 43(5), 805-811. <http://dx.doi.org/10.1016/j.respol.2014.03.001>
- Yin, R.K. (2005). *Estudo de Caso-Planejamento e Método*. Porto Alegre, RGS: Bookman.
- Young, B., Hewitt-Dundas, N., & Roper, S. (2008). Intellectual Property management in publicly funded R&D centres - A comparison of University-based and company-based research centres. *Technovation*, 28(8), 473-484. <http://dx.doi.org/10.1016/j.technovation.2008.02.004>

# Active Internationalization of Small and Medium - Sized Software Enterprises - Cases of French Software Companies

Maurício Floriano Galimberti <sup>\* 1</sup>, Raul Sidnei Wazlawick <sup>1</sup>

**Abstract:** Implementations of software production processes usually ignore organizational, market, and economical attributes of products that are to be inserted in international markets. Software engineering has begun to deal with the business aspects of software products only recently. The Guide to the Software Engineering Body of Knowledge v3.0 presents two concepts of life cycle: the software development life cycle and the software product life cycle. The second is more concerned with business issues related to software products, but research on those issues is still due. In this sense, this paper aims to answer the following question: what factors allow small and medium software enterprises to offer high value added products in order to enter and remain in the international market? This work selects four research dimensions from literature and explores a number of variables inside those dimensions, which are considered as candidates to help explaining a successful process of active internationalization. The paper presents a multiple case study that shows that although innovation, entrepreneurship, and foreign market knowledge are important dimensions for the active internationalization, networking is not as relevant as it could be thought.

**Keywords:** active internationalization; software product life cycle; software internationalization; French software SMEs.

Submitted: July 29th 2015 / Approved: December 2nd 2015

## 1. Introduction

In general, software production processes ignore organizational, market and economical attributes of products that are to be inserted in international markets. Business aspects began to be timidly addressed only in the past 20 years. However, they have increased significantly in the past five years. Currently, there are process models (e.g. EUP – Enterprise Unified Process (Ambler, Nalbone, & Vizdos, 2005) that address the software life cycle in a broader view, including specification of activities that range from software maintenance to software retirement from the market, and which consider activities aimed at the business.

Software Product Lines (SPL) are committed to that idea. An SPL may be seen as a family of software systems that share common features, managed to attend the specific needs of a market segment. Those products are developed from a common core in a systematic way. Reference (Northrop, 2008) remarks that SPL may be seen as an evolution of software reuse strategies, and (Wazlawick, 2013) adds that the reuse obtained with SPL is a strategic approach for the software industry, making reuse less unpredictable and systematically incorporated to the productive processes.

Formally, Software Engineering has begun to systematize the business aspects of software product more recently with the third version of the Guide of the Software Engineering Body of Knowledge, commonly referred as SWEBOK. SWEBOK v3.0, launched in the end of 2013, presents 15 Knowledge Areas (KA), and the 12th KA is called

Software Engineering Economics. The importance of the business context for software engineering is highlighted by the presentation of two software life cycles: the software development life cycle (SDLC) and the software product life cycle (SPLC).

“A software product life cycle (SPLC) includes all activities needed to define, build, operate, maintain, and retire a software product or service and its variants. The SPLC activities of ‘operate’, ‘maintain’, and ‘retire’ typically occur in a much longer time frame than initial software development (the software development life cycle—SDLC—see Software Life Cycle Models in the Software Engineering Process KA). Also the operate-maintain-retire activities of an SPLC typically consume more total effort and other resources than the SDLC activities (see Majority of Maintenance Costs in the Software Maintenance KA). The value contributed by a software product or associated services can be objectively determined during the ‘operate and maintain’ time frame. Software engineering economics should be concerned with all SPLC activities, including the activities after initial product release” (Bourque & Fairley, 2014).

The internationalization of small and medium-sized enterprises (SMEs) within the software sector is growing in various regions of the world, but the theories and models of internationalization have only shown a limited capacity to explain the success of SMEs in international markets. Until 2002, most studies on internationalization focused on multinational corporations. Reference (Axinn & Matthysens, 2002) stress that most classical studies on internationalization focus on manufacturers, especially from developed countries.

<sup>1</sup> Department of Informatics and Statistics (INE), Federal University of Santa Catarina (UFSC), Florianópolis, Brazil

\*Corresponding author: m.f.galimberti@ufsc.br



Additionally, the process of internationalization of a company may be active or passive. Roselino defines active internationalization as the ability of companies to become proactively able to sell and to remain selling their products in foreign markets (Roselino, 2006). Further investigation on the active internationalization of SMEs offering innovative high technology products is still due. Innovation should also be a guideline for internationalization in the software industry (Ronkko, Ojala, & Tyrvaïnen, 2013). This paper covers this gap by studying the active internationalization of software SMEs aligned with the tendencies presented in SWEBOK v3.0.

France, as a mainstream country in terms of technology, was chosen for the investigation. Even though the United States is the biggest software market, estimated in US\$112.2 billion in 2008, other countries with a similar international behavior should also be observed (Datamonitor, 2008b)<sup>1</sup>. This is the case of Germany, France and the United Kingdom, in which the internationalization is usually active, because those countries do not appear in the ranking of the 10 greatest outsourcing providers, although they respectively shared 29.8%, 15.8% and 20.8% of the European software market in 2008. This means that together they respond for 66.4% of the market in Europe, with an income of US\$91.5 billion (Datamonitor, 2009) (Datamonitor, 2008a).

This study is concerned about the high added-value software sector. Since this sector can offer greater opportunities for companies from developing countries, it is relevant to learn from the behavior of companies from developed countries, such as France. Therefore, the main research question of this paper is: what are the factors that enable high added-value software SMEs to enter and remain in the international market? Based on a literature review, we propose a model with four research dimensions and a number of candidate variables considered relevant to influence a successful process of active internationalization. The four dimensions are innovation, entrepreneurship, relationship networks, and knowledge about the foreign market.

This article has six further sections. The next section presents the theoretical framework and the current models of internationalization. The third section presents the model for active internationalization of software SMEs. The fourth section presents the adopted research method, and the fifth one offers a description of three case studies of internationalization in French software SMEs. The sixth section discusses some results under the light of the research propositions. The last section is reserved for final considerations and future studies.

## 2. Research Background

Although there are various classifications on internationalization theories, in this study, they are distinguished as *general* or *specific*. The general models and theories of internationalization do not distinguish small and large companies in the process of expansion into foreign markets. Therefore, they usually explain the internationalization phenomenon from the point of view of large multinationals, especially manufacturers (Andersen & Buvik, 2002). General models have received criticism from numerous authors,

such as Andersson (Andersson, 2000), Axinn e Matthyssens (Axinn & Matthyssens, 2002), and Johanson and Vahlne (Jan Johanson & Vahlne, 2003). They argue that there is a need for new models of internationalization that consider current markets and technology dynamics, with faster internationalization processes than those that existed when most of the general models were formulated.

The specific models and theories of internationalization, on the other hand, focus on the features of small companies. Those features were selected for a detailed analysis, which led to the identification of the variables presented in the research model.

Regarding the scope of this paper, the theoretical discussion focuses on specific models and theories that were analysed in order to search for those that explain the active internationalization of SMEs in the area of innovative and high technology products and services. This paper focus on the process of active internationalization and its success. In this context, a successful company is one that is not shrinking and is self-sustained by its international activities. This research looks for the factors that have actual impact on the success of the internationalization of that kind of company.

The *Innovation-Based Models of Internationalization (I-Models)* are considered as specific models. Although those models date from almost the same era as the general models, they consider the need to differentiate the size of the company during the internationalization process. However, similarly to general models, they consider internationalization to be a process that occurs in stages, which represents a feature common to main I-Models (Bilkey & Tesar, 1977) (Cavusgil, 1980) (Czinkota, 1982) (Reid, 1981). Those models differ from one another mainly in terms of the number of stages included and their respective descriptions. Nonetheless, there are no substantial differences in the essence of the processes. The contribution of the I-Models is significant in two aspects: (1) because they differentiate the internationalization process in SMEs and (2) they offer *innovation* as an explanation for internationalization. In the first aspect, (Reid, 1981) suggests research on exports and other entry modes in foreign markets. Under these circumstances, the SMEs should pay more attention to the individual characteristics of the entrepreneur and decision maker, and on how those characteristics affect the exporting behavior. Regarding the second aspect, the I-Models consider the internationalization process as an innovative strategic initiative.

The *Networks Model* (Jan Johanson & Vahlne, 2003) is an extension to the Uppsala Model (J. Johanson & Vahlne, 1977); both models were proposed by Johanson and Vahlne. Even though it is based on large multinational companies, the Networks Model explains that the decision making process regarding internationalization activities is directly or indirectly determined by what occurs in local business networks. That knowledge may be applied to international markets. Reference (Jan Johanson & Vahlne, 2003) also mention that the model can explain a great deal about the growth process of small firms that undertake activities in foreign markets. Chetty and Holm state that, as a strategy, the

<sup>1</sup> Datamonitor conducted this research until 2009 only.

company should establish relationships in new countries (international extension), or increase its participation in previously established markets, or still integrate its positions in networks in different countries (international integration) (Chetty & Blankenburg Holm, 2000).

The *Theory of International Entrepreneurship* explains the international expansion of new and established SMEs that need to expand their activities to other markets. Reference (Andersson, 2000) claims that the process of internationalization is not an activity that can be separated from the other ones; it is rather a consequence of the company's strategy. That would characterize strategy as an entrepreneurial action.

There is also an approach denominated as "Born Global", which was first used by (Rennie, 1993). Born Global firms are SMEs that are constituted with a view on internationalization, or, at least, which begin to act internationally after the first few years in the domestic market. The Born Global phenomenon is still contested, based on the argument that general theories and models of internationalization could explain. However, a growing number of studies identify special characteristics to such firms, as, for example, (Phillips McDougall, Shane, & Oviatt, 1994), (Madsen & Servais, 1997), (Harveston, Kedia, & Davis, 2000), (Sharma & Blomstermo, 2003), and (Chetty & Campbell-Hunt, 2004). Consequently, the central characteristics that define a Born Global SME are considered to be the age of the company when it begins its international activity and the share of its revenue obtained from international markets.

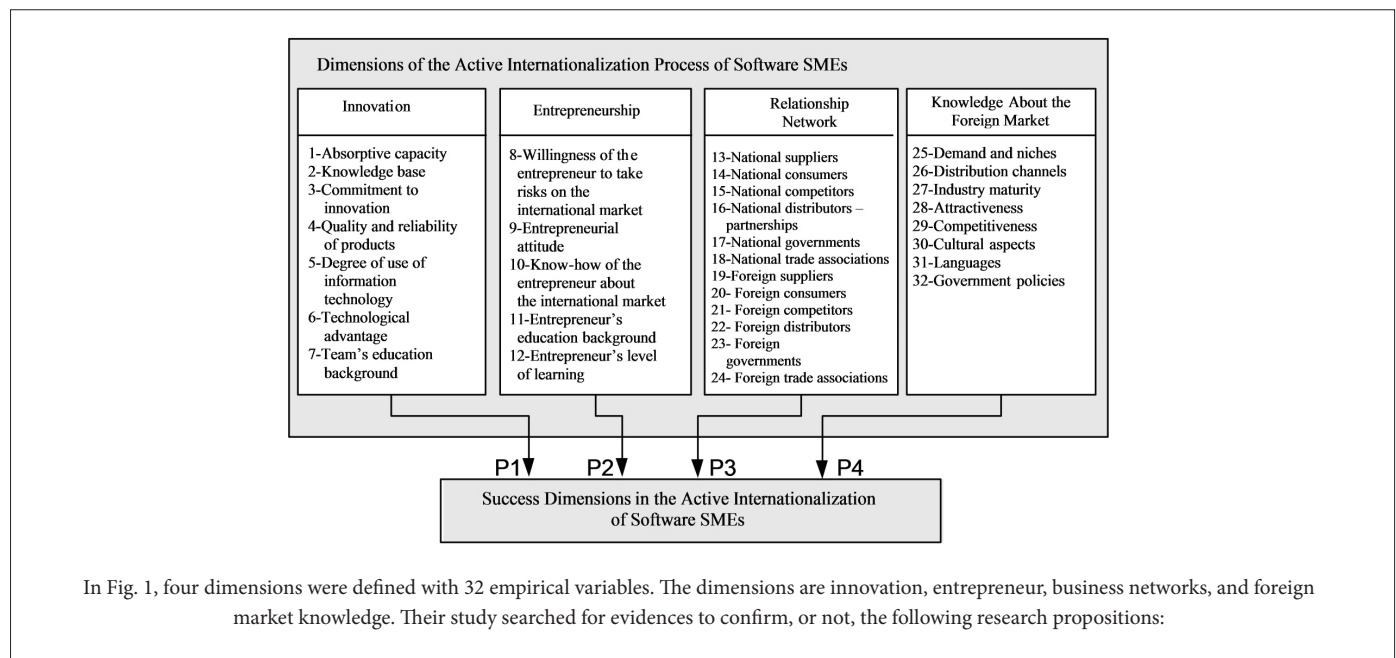
### 3. Model of Active Internationalization of Software SMEs

Many factors influence high-value added software products and services positioning in the global market; and one of them is *innovation*. Both passive and active internationalization are related to innovation and to the qualification of professionals from these companies. Roselino mentions that in an *active* process of internationalization, the process of innovation is originated from the main corporate head-quarter (Roselino, 2006). Moreover, the software products developed by highly qualified software engineers are characterized by the addition of a high-value. An example of an active process of internationalization is the practice of the North American software industry, which dominates the Internet market.

On the other hand, the *passive* process of internationalization consists on rendering services of low or average value added; it does not depend on the outsourcing country to have high standards in software engineering. Many companies at India are examples of the passive process of internationalization.

"The factors that influence the internationalization process of SMEs of software and related services depend on the stage of development of the firm and its relation with innovation as well as the proper capacities of the entrepreneur" (Galimberti & Dorion, 2011). The specific internationalization approaches normally refer to SMEs, the entrepreneur, their services and innovations, but there is no research, established model, or theory compiling all these subjects and addressing them related to a specific sector such as the software industry.

The approaches aforementioned proposed a number of features for the analysis of active internationalization. Based on these features, (Galimberti & Dorion, 2011) have established the model that summarize the dimensions and candidate variables that could contribute to the process of active internationalization, which is adapted in Fig. 1.





**P1:** *The degree of service or product innovation influences the success of the process of active internationalization of a software SME.* This proposition deals with the influence of innovation on the process of active internationalization of the SMEs, which is studied through the variables of the innovation dimension of the model.

**P2:** *The attributes of entrepreneurship influence the success of the process of active internationalization of a software SME.* This proposition refers to the entrepreneur's attributes for the success of the internationalization process of the company, which are studied through the variables of the entrepreneurship dimension of the model.

**P3:** *The networks maintained by a software SME and related services influence the success of active internationalization.* This proposition refers to the implications and the impact of the configuration of networks on active internationalization process, which are studied through the variables of the network dimension of the model.

**P4:** *The knowledge of foreign markets influences the degree to which software SMEs are successful in obtaining active internationalization.* This proposition deals with the configuration of the foreign market knowledge as determinant to the internationalization process, which is being studied through the variables of the foreign market knowledge dimension of the model.

Each proposition is discussed along with the presentation of the results.

#### 4. Research Method

The research strategy of this study is qualitative. The object of the study is composed by three leading French software companies, which performed a successful process of active internationalization. The investigation method consists of empirically collecting data by means of in-depth semi-structured basic interviews with manage-

ment people from each company. A secondary data collection is based on a systematized research including books, journals, newspapers, magazines, dissertations, and theses, among other sources. Case studies allow the use of multiple evidence sources as an extensive research strategy (Yin, 2013). With data triangulation, it is also possible to dedicate attention to the potential problem of construct validity, because more evidence sources provide different evaluations for the same phenomenon.

The criteria that define the selection process of the software companies to be studied are the following:

- Each company must be characterized as an SME as defined by the European Commission;
- Each company must have business results from other countries and must be sustainable with its activities abroad;
- Each company must have had international activities for more than two years;
- Each company must have a total income compatible with SMEs average income, regardless the way the company accessed international markets; and
- Each company must have autonomy regarding the high value products or services it offers, meaning it carries out active internationalization.

The research protocol was initially implemented in one pilot case study in France. The quality of the data obtained justified keeping the pilot case study and the same structure of interviews for the two other cases.

To comply with the research protocol, two entrepreneurs and a manager in each French SME were interviewed, showing the business profile shown in Table 1. The data set is organized regarding the scope of the paper and the analysis presented in the current section.

Table 1. Software SMEs research in France and selection criteria

French Software SME	Nº. of Employees	Annual Income	% of International Income	Opening / International
FRAN*	55	€5 million	40–50%	2000/2000
EDIT*	55	€9 million	5%	2000/2004
LILI*	25	€2.7 million	10%	1985/1987

\* Fictitious names

The classification of the French companies took into consideration the definitions of the European Commission (Liidanen, 2003): an SME must not have more than 250 employees, must not be a branch of an industrial group, and the volume of its annual business must not exceed €50 million. Within this category, a small company employs less than 50 people and the annual business volume does not exceed €10 million, and a micro company employs less than 10 people and the annual business volume does not exceed €2 million.

#### 5. Results

The three cases studied in this work are described in the following subsections.

##### A. The Fran Case

The first case, called here “Fran”, is a French private capital company that develops software for specific business segments that search and



organize specialized documents and information. Seven entrepreneurs founded the company in 2000, and currently they own 30% of the company shares.

Fran, which was created by entrepreneurs with extensive experience in the software industry, acts specifically in the development of software technology with data mining, information search, and indexing capacities, which are also commonly known as *search engine* or *search machine technology*. Fran holds the full property and design rights over its products. In 2007, the company's total revenue reached €5 million, and the percentage of revenue from abroad was in the order of 40% to 50%. This percentage has been relatively stable since the year of its foundation.

In relation to the size of Fran and the market in which it acts, it was said that the company, "[...] while quite young, is more than a start-up company, this is an SME". However, the General Director considers that in relation to the market and the sector, "[...] we are big, we are leaders in Europe and currently world leaders after the acquisition of two competitors. We have been leaders in terms of technology for some time and now we are also market leaders".

Fran may be classified in the category of *born global* since from its first year it began to sell its products in Germany, established a subsidiary in Switzerland and a sales office in Italy, along with France. So, "[...] from the beginning Fran was conceived of as a European company, with revenue coming also from Italy, Switzerland and Germany. Two years after founding the company, luckily, we got our first customers from the U.S. In 2004 the North American office was established to prospect for clients, which became a subsidiary in 2006. These were the main countries, but throughout this process of internationalization commercial contacts were maintained in the United Kingdom, Holland and Belgium".

Fran choose to work on four segments, depending on an analysis of the targeted external market. The segments are: (1) pharmaceutical, (2) publishing/press, (3) security for the public sector, industry and banks, and (4) sale of technology, or OEM (Original Equipment Manufacturer), to other software companies.

In France, the strategy is to cover all four segments, due to the existing demand and the size of the company structure. In other countries, where it has subsidiaries, such as Germany and the U.S., one or two segments are pursued, in these cases the pharmaceutical and the publishing/press industries.

Business functions are distributed according to the strategic and operational needs. The strategic management is located in Paris. Product development takes place in Paris and Grenoble. There is no development in other countries, and usually, the software is written in English. Depending on the location this can be adapted to Italian, French and German, if needed, but the process was said to be fairly simple. As a result, the products and services that are developed and sold are identical in all countries.

## B. The Edit Case

The company whose pseudonym here is "Edit" was founded in May 2000 by two entrepreneurs, who currently are the only shareholders and hold the posts of chairperson and chief executive officer. Edit is a limited company with 55 employees and had a revenue of €9 million in 2007, 5% of which came from its activities abroad.

In France, Edit is characterized as a software concepteur-editeur, which means that it designs, develops and sales software products. It produces software to be used in the automatic generation of other software, which means it could fit in the segment of Computer-Aided Software Engineering (CASE) tools, with the important difference that while CASE tools are intended for developers, Edit's products are targeted at business analysts. Edit also sales a CASE tool from the United States, but this is not the focus of its activity.

To consolidate Edit was a very difficult and troubled process. In 2001, only one year after the company was founded, the markets suffered a blow, due to the 9/11 attacks in the United States. In 2003, a new prototype was conceived and designed, and they approached the French Ministry of Research, driven by the innovative aspects incorporated into the product, as the chairperson recalls: "So they told us, yes, cool, this product is very innovative, there is nothing similar in the rest of the world. So they lent us the money to complete the project, and now we are paying it back." This happened in 2004, and thereafter the firm effectively began to internationalize. He adds that "[...] now, it is okay, the product is good, we have started to internationalize to Anglo-Saxon countries." Today Edit has operations in France, the United States of America and the United Kingdom.

The company's strategy to access international markets, especially the American market, consisted of two stages: first, one of the entrepreneurs went to the United States to present the product. The reaction of people was noted to see whether the concept was adapted to the market and whether the presentation and marketing method were suited to the market, in order to implement any necessary adjustments. In the second stage, potential client companies in the United States that also had businesses in France were surveyed, and a search was made for partners and distributors for prospecting and selling software in the United States of America.

Contacts with the North American market are usually conducted online, using a teleconference tool, speaking in French and English to facilitate international communication. The chairperson said that the company does not seek to reach every country; they are interested only in those with greater demand, such as the United States. Even in those countries, the strategy chosen is to find and retain distributors. He added, "I do not want to manage 1000 people, but instead I want to have resellers. In the United States, there are partners. Our partner in the United States is a representative".

The firm's specific functions are geographically distributed. The central and commercial base is located in Suresnes, in the metropolitan

area of Paris. Support for development is carried out in Pessac, in the Bordeaux region. The teleconferences and technical seminars, which are a strong mechanism for communication and company marketing, along with development, are conducted from Casablanca (Morocco), where Edit's R&D laboratory is located.

### C. The Lili Case

The last company in the study goes by the pseudonym "Lili". Two entrepreneurs founded the company in 1985. Its focus is on developing and marketing software and statistical support for scientific research. Currently the company has 25 people on its staff, with 16 in Annecy and 9 in Grenoble. Lili is characterized as a small business, both by the number of employees and by terms of revenue, which was €2.7 million in 2007. The entrepreneur that was interviewed pointed out that the percentage of revenue coming from abroad is around 10% to 15%, with a small growth of around 2% each year: "You can see, it was €191 thousand in 2005, €202 thousand in 2006, and €260 thousand in 2007."

The entrepreneur points out that "[...] these values are in direct sales to consumers who access Lili's site in order to make a purchase." There is still a part, the remainder, which represents sales through resellers in other countries. "Most come from Switzerland, probably because it is a Francophone country, where we have sellers, then come Germany, Brazil, Belgium, Senegal, Morocco and Ireland, where we have the same types of partners."

Activities abroad began, in the words of the entrepreneur, "[...] as an opportunity and not by our efforts. This happened, almost from the start in 1987 in Turkey". In 1990, they began to sell in the United Kingdom, moving to another distributor in 1996. In 1995, activities began in Brazil. In the year 2000, they reached access to the German market and hence the business began to expand to other countries.

One of the dimensions highlighted as being crucial for the expansion of the company into international markets was a business strategy based on low price and mass distribution. The initial projects began as result of the academic experience of one of the entrepreneurs, moving on to larger markets due to the demand and the opportunities that arose, which caused the company to design a software application for the market in general.

After a certain period, the strategy changed from one of *opportunism* to one of *voluntarism*, that is, they started to seek partners and international distributors. As the entrepreneur says, "the search now is for an existing company, which already has activities in the sector of interest, that may even distribute for a competitor, and that will put our software into its product portfolio."

A great difficulty found both at the founding of the company and at the beginning of the internationalization process concerns obtaining financial investment. He stressed that this is no longer a problem for Lili to access other markets because "we have money", but it is very hard to start a small business, let alone going international.

## 6. Discussion

A description of each case, actually summarized for this paper, shows that product innovation as well as the rights resulting from its development are characterized as an active process of internationalization. The data analysis of each case enhances the evidences identified from the synthesis of the results through the attributes of the research model, dealing with each variable in terms of positive or negative intensity of citation during the process of data collection. The intensity degree, although qualitative, was assigned based on several systematic considerations presented elsewhere (Galimberti, 2009) whose presentation unfortunately would not fit in this paper.

### A. Proposition P1

The first dimension refers to the innovation attributes, and Table 2 presents the results that are interpreted in terms of Proposition P1. This proposition deals with the influence of innovation on the process of active internationalization of the SMEs and it may be analyzed through the variables of Table 2.

Table 2. Dimensions of INNOVATION – Indicator Intensity

Variables	Cases			Partial Conclusions
	Fran	Edit	Lili	
1-Absorptive capacity	+	+ -	-	+ -
2-Knowledge base	+	+	+ -	+
3-Commitment to innovation	+	+	+ -	+
4-Quality and reliability of products	+	+	+	+
5-Degree of use of information technology	+ -	+ -	-	+ -
6-Technological advantage	+	+	+ -	+
7-Team's educational background	+	+	+	+

Captions: (x) no intensity; (-) low intensity; (+ -) medium intensity; and (+) high intensity.

The three French companies operate in highly complex software segments that demand the high quality and reliability from their software, which is consistent with the needs of application sectors. The technological differential is present in the three software companies, being more evident in the Fran company, which also has the best results in terms of international revenues. The educational level of the staff was quite high, both among those involved in management activities and in the teams of software developers, which, in the case of Fran, also included specialists in segments of the software application. These variables help to confirm the high commitment of the enterprises to innovative activities, even depending on it in order to find a niche in markets already dominated by larger companies.

Given their characteristics, Fran and Edit may be classified as Born Global, especially because they were established with an eye on the international market. Additionally, the above aspects confirm for the three companies what the *Born Global* Perspective claims regarding the importance of quality products for internationalization, as well as technological advantage, which is also advocated by the Theory of International Entrepreneurship. The high-level staff training appears to be closely related to the innovation of products and that supports the proposition that it has an important role in active internationalization.

Proposition 1 is confirmed in the French cases: innovation proved to be crucial to the SMEs active internationalization process as shown by the intensity of the firms commitment to innovation, concern with the quality and reliability of their products, search for technological advantage and high qualification of their staff at all stages of the internationalization process, and an average impact of absorptive capacity. The variable related to the creation and maintenance of knowledge bases was the only variable that appeared only in an advanced stage of internationalization.

### B. Proposition P2

The second proposition refers to the entrepreneur's attributes for the success of the active internationalization process of the company, as presented at Table 3.

In all cases, the French entrepreneurs proved to have the main characteristics required for the internationalization process.

Table 3. Dimensions of ENTREPRENEURSHIP – Indicator Intensities

Variables	Cases			Partial Conclusions
	Fran	Edit	Lili	
8-Willingness of the entrepreneur to take risks on the international market	+	+	+ –	+
9-Entrepreneurial attitude	+	+	+	+
10-Know-how of the entrepreneur about the international market	+	+ –	–	+
11-Entrepreneur's educational background	+	+	+	+
12-Entrepreneur's level of education	+	+	+ –	+

Captions: (x) no intensity; (–) low intensity; (+ –) medium intensity; and (+) high intensity.

Regarding the willingness of the entrepreneurs to take risks in the international market, it is evident in the case of the entrepreneurs from Edit and Fran. They had the initiative to take their products outside France and seek investments to boost their international position.

The entrepreneurs of the three firms have an equivalent level of edu-

cation. However, Lili's entrepreneur did not have formal education in computer science. It should be further investigated whether such aspect influenced on the late internationalization of Lili, because the entrepreneur, with a different background maybe was afraid to invest on other markets while the company was beginning.

### C. Proposition P3

The third proposition concerns to the impact of networking on the process of active internationalization. Based on data presented at Table 4, it can be said that only few of the commonly referred types of networks contribute to the internationalization process.

Table 4. Dimensions of RELATIONSHIP NETWORK – Indicator Intensities

Variables	Cases			Partial Conclusions
	Fran	Edit	Lili	
13-National suppliers	x	–	x	x
14-National consumers	+	+	+	+
15-National competitors	x	x	x	x
16-National distributors – partnerships	+	+	x	+
17-National governments	+ –	x	x	x
18-National trade associations	–	x	–	–
19-Foreign suppliers	x	+	x	x
20-Foreign consumers	+	+	–	+
21-Foreign competitors	x	x	x	x
22-Foreign distributors – partnerships	+ –	–	+ –	+ –
23-Foreign governments	–	x	x	x
24-Foreign trade associations	x	x	x	x

Captions: (x) no intensity; (–) low intensity; (+ –) medium intensity; and (+) high intensity.

The relationships maintained by the French companies within their territory are limited to domestic consumers, national distributors (partnerships) and in lesser degree with professional associations. Consumers play a fundamental role for French companies regarding the pursuit of ideas for implementing innovative features in software products. In terms of French distributors, partnership engagement to develop technology is considered more important than distribution networks, as suggested by the Networks Model. Involvement with professional associations proved to have no influence on the success of internationalization.

In relation to international involvement, the French companies have shown little commitment to establish relationships through networks except with international customers, which is more evident in the two

companies that maintain offices or subsidiaries abroad. These companies also have relationships with international distributors at a more advanced stage of internationalization, while the company that developed actions with foreign distributors from the beginning of the process has little involvement with international customers. Therefore, for these French SMEs, networking is important only with a few relevant stakeholders.

#### D. Proposition P4

This proposition is concerned with the configuration of the knowledge about the foreign market as determinant to the internationalization process; it is analyzed through the variables of Table 5.

Half of the variables within this dimension suggest similarities between the French companies, but they were all considered relevant from the beginning of the internationalization of these companies. It was mentioned that demand and market niches, as well as maturity and attractiveness of markets, were thoroughly considered by entrepreneurs who have built up their business thinking of selling their products in the international market.

According to definitions from Rennie (Rennie, 1993), McDougall (McDougall, 1989), and Sharma and Blomstermo (Sharma & Blomstermo, 2003), the Born Global phenomenon may be applied to the Fran and Edit companies. However, the emphasis on knowledge of the external market was not found in the Born Global literature, except in relation to market niches. The three companies have also emphasized a concern regarding cultural aspects of the countries where they intend to act and minimize the importance of the foreign language. In this sense, it is important to highlight that these people, who are part of the French companies since their foundation, are fluent in English. Nevertheless, this was not a resource that worried them, being that English is considered the main means of communication by the entrepreneurs, even in countries where other languages are spoken, such as Germany or Italy.

The aspects related to competitiveness and distribution channels have demonstrated a moderate degree of influence on the success of the French companies, two of which maintain their own subsidiaries in other countries and, with their growth, are now considering using distributors abroad. The only variable with low intensity is related to the knowledge of government policies, only highlighted by the Fran Company, which develops software aimed at public safety.

Table 5. Dimensions of KNOWLEDGE ABOUT THE FOREIGN MARKET– Indicator Intensities

Variables	Cases			Partial Conclusions
	Fran	Edit	Lili	
25-Demand and niches	+	+	+ –	+
26-Distribution channels	–	–	+ –	+ –
27-Industry maturity	+	+	+ –	+

Variables	Cases			Partial Conclusions
	Fran	Edit	Lili	
28-Attractiveness	+	+	+ –	+
29-Competitiveness	+	–	+ –	+ –
30-Cultural aspects	+	+	+	+
31-Languages	+	–	+ –	+ –
32-Government policies	+ –	x	x	–

Captions: (x) no intensity; (–) low intensity; (+ –) medium intensity; and (+) high intensity.

#### 7. Final Considerations

The four dimensions explored in this research are straightly related to the software engineering processes, especially those included in the SPLC, as mentioned by the SWEBOK v3.0. Most of the 32 candidate variables investigated are related to topics included in the knowledge area of software engineering economics in SWEBOK v3.0: among others, the topic on *decision-making process*, in the section of *software engineering economics fundamentals*. Many topics in *life cycle economics*, such as *product life cycle* and *project life cycle*, *investment decisions*, *planning horizon*, *price and pricing*, *cost and costing*, and *replacement and retirement decisions* are also included both in SWEBOK and this research.

Amongst the reviewed theories and approaches, the Born Global concept has a lot in common with the characteristics of French software SMEs and, therefore, it can be used to explain their active internationalization process. It can also be concluded that the degree of innovation of the products the SMEs sell in foreign markets can determine the level of success of their internationalization process. The main characteristics of the I-Models suggest that the decision to internationalize should be considered a specific process of innovation within the company. It can be seen from this study that certain features, such as knowledge and innovation, are directly related to quality and reliability, technological edge and the use of partnerships (networks) as a core strategy.

There is a strong similarity between the approaches taken by this type of entrepreneur, with the variables identified in a Born Global perspective. However, the ones that refer to innovativeness, product quality and reliability and technological edge, as well as the variables related to the experience of the entrepreneur, are present in both the Born Global perspective and in the I-Models.

In relation to the attributes of the entrepreneur, they are likely to have an impact on the success of the process of internationalization of the SMEs. The relevance given to the entrepreneur is evident in each of the specific approaches considered in this article as reference to the Theory of International Entrepreneurship and the Born Global perspective. Concerning International Entrepreneurship, the preferences of the entrepreneur can be added as a variable within the I-Models and Born Global perspective, in order to structure a construct related



to the role of the entrepreneur in the process of internationalization. This paper shows that many studies have highlighted the role of the entrepreneur in the process of internationalization of a company. Together with the concept of innovation as a determinant strategy for the internationalization process, they are shown to constitute the most relevant research dimensions for the success of the active process of internationalization of the software SMEs.

The main discrepancy found comparing the results with the preliminary research model and literature is related to the engagement with national distributors (variable 16). The companies studied shown large involvement with national technological partners, as predicted by the Born Global Perspective, but not with national distributed, as predicted by the Networks Model. Besides that, more than half variable that deal with network involvement were not confirmed or shown low intensity.

Therefore, the analysis of the results, in relation to the variables identified in the model shown in Figure 1, leads to the conclusion that to be successful in its process of internationalization an SME must: (1) have the capacity to innovate, (2) be a leader with high level of entrepreneurship, (3) have the capacity to insert itself in relevant networks, and (4) have knowledge of the foreign market with different specificities due to the evolution of the international activities.

In this sense, it was attempt to find a set of theories and models that would describe and bring to light the degree of agreement with the four highlighted dimensions. It can be stated that the four research dimensions and their variables fulfilled the research objectives of finding which variables may contribute to the success of the SMEs in their pursuit of continuous business with innovative products in international markets. This study is exploratory, since it opens new thinking about the importance and the feasibility of implementing active internationalization processes in SMEs. Although the realities of only three companies were explored, the value of this study rely on its potential for generalization. Despite a generalization based on three case studies cannot be completely assured, there are indications that these findings might provide basis not only for small and medium companies with business projects in software but also for other innovative high technology products. However, the generalization of this study for developing countries may not be so assertive; thus, we suggest future studies, especially with samples of small firms from developing countries, to test the validity of the proposed model. Additionally, broader studies are suggested to evaluate internationalization process, as well as the organizational results generated as result of the implementation of these strategies, with a greater number of companies.

## Acknowledgment

This work was partially supported by *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES)*.

## References

- Ambler, S. W., Nalbone, J., & Vizdos, M. J. (2005). *The Enterprise Unified Process: Extending the Rational Unified Process*. Prentice Hall PTR. Retrieved from <https://books.google.com/books?id=r-hiQgAA-CAAJ&pgis=1>
- Andersen, O., & Buvik, A. (2002). Firms' internationalization and alternative approaches to the international customer/market selection. *International Business Review*, 11(3), 347–363. [http://doi.org/10.1016/S0969-5931\(01\)00064-6](http://doi.org/10.1016/S0969-5931(01)00064-6)
- Andersson, S. (2000). The internationalization of the firm from an entrepreneurial perspective. *International Studies of Management and Organization*. Retrieved from <http://www.scopus.com/inward/record.url?eid=2-s2.0-0012814740&partnerID=tZOtx3y1>
- Axinn, C. N., & Matthyssens, P. (2002). Limits of internationalization theories in an unlimited world. *International Marketing Review*, 19(5), 436–449. <http://doi.org/10.1108/02651330210445275>
- Bilkey, J., & Tesar, G. (1977). The export behavior of smaller Wisconsin manufacturing firms. *Journal of International Business Studies*, 9(1), 93–98.
- Bourque, P., & Fairley, R. E. (2014). *Guide to the Software Engineering Body of Knowledge (SWEBOOK)*. IEEE Computer Society.
- Cavusgil, S. (1980). On the Internationalization Process of Firms. *European Research*, 8, 273–281.
- Chetty, S., & Blankenburg Holm, D. (2000). Internationalisation of small to medium-sized manufacturing firms: A network approach. *International Business Review*, 9(1), 77–93. Retrieved from <http://www.scopus.com/inward/record.url?eid=2-s2.0-0034134949&partnerID=tZOtx3y1>
- Chetty, S., & Campbell-Hunt, C. (2004). A Strategic Approach to Internationalization: A Traditional Versus a “Born-Global” Approach. *Journal of International Marketing*, 12(1), 57–81. Retrieved from <http://www.scopus.com/inward/record.url?eid=2-s2.0-1642387422&partnerID=tZOtx3y1>
- Czinkota, M. (1982). Export development strategies: US promotion policy. Retrieved from <https://scholar.google.com/scholar?cluster=7373618366045398112&hl=en&oi=scholar#0>
- Datamonitor. (2008a). *Software in France: Industry Profile 2008*. Retrieved from <https://www.datamonitor.com/>
- Datamonitor. (2008b). *Software in United States: Industry Profile 2008*. Retrieved from <https://www.datamonitor.com/>
- Datamonitor. (2009). *Software in Europe: Industry Profile 2008*. Retrieved from <https://www.datamonitor.com/>
- Galimberti, M. F. (2009). *Fatores de Sucesso na Internacionalização Ativa de Pequenas e Médias Empresas de Software: estudo de casos do Brasil e da França*. Universidade Federal do Rio Grande do Sul.
- Galimberti, M. F., & Dorion, E. C. H. (2011). Active internationalisation



- of Brazilian SMEs from the software sector. *International Journal of Management and Enterprise Development*.
- Harveston, P. D., Kedia, B. L., & Davis, P. S. (2000). Internationalization of Born Global and Gradual Globalizing Firms: The Impact of the Manager. *Advances in Competitiveness Research*, 8(1), 92. Retrieved from <https://www.questia.com/library/journal/1P3-68959937/internationalization-of-born-global-and-gradual-globalizing>
- Johanson, J., & Vahlne, J. (1977). The internationalization process of the firm: a model of knowledge and increasing foreign market commitments. *Journal of International Business Studies*, 8(1), 23–32.
- Johanson, J., & Vahlne, J.-E. (2003). Business Relationship Learning and Commitment in the Internationalization Process. *Journal of International Entrepreneurship*, 1(1), 83–101. <http://doi.org/10.1023/A:1023219207042>
- Liidanen, E. (2003). Concerning the definition of micro, small and medium-sized enterprises. *Official Journal of the European Union*. Retrieved from <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:124:0036:0041:EN:PDF>
- Madsen, T. K., & Servais, P. (1997). The internationalization of Born Globals: An evolutionary process? *International Business Review*, 6(6), 561–583. [http://doi.org/10.1016/S0969-5931\(97\)00032-2](http://doi.org/10.1016/S0969-5931(97)00032-2)
- McDougall, P. P. (1989). International versus domestic entrepreneurship: New venture strategic behavior and industry structure. *Journal of Business Venturing*, 4(6), 387–400. [http://doi.org/10.1016/0883-9026\(89\)90009-8](http://doi.org/10.1016/0883-9026(89)90009-8)
- Northrop, L. (2008). *Software Product Lines Essentials* (No. 15213-2612). Pittsburgh. Retrieved from <http://www.sei.cmu.edu/library/assets/spl-essentials.pdf>
- Phillips McDougall, P., Shane, S., & Oviatt, B. M. (1994). Explaining the formation of international new ventures: The limits of theories from international business research. *Journal of Business Venturing*, 9(6), 469–487. [http://doi.org/10.1016/0883-9026\(94\)90017-5](http://doi.org/10.1016/0883-9026(94)90017-5)
- Reid, S. D. (1981). The Decision-Maker and Export Entry and Expansion. *Journal of International Business Studies*, 12(2), 101–112. <http://doi.org/10.1057/palgrave.jibs.8490581>
- Rennie, M. W. (1993). Born Global. *The McKinsey Quarterly*, (4), 45. Retrieved from <https://www.questia.com/library/journal/1G1-15424561/born-global>
- Ronkko, M., Ojala, A., & Tyrvaenen, P. (2013). Innovation as a driver of internationalization in the software industry. In *2013 International Conference on Research and Innovation in Information Systems (ICRIIS)* (pp. 49–54). IEEE. <http://doi.org/10.1109/ICRIIS.2013.6716684>
- Roselino, J. E. (2006). *A Indústria de Software: o “modelo brasileiro” em perspectiva comparada*. Universidade Estadual de Campinas.
- Sharma, D. D., & Blomstermo, A. (2003). The internationalization process of Born Globals: a network view. *International Business Review*, 12(6), 739–753. <http://doi.org/10.1016/j.ibusrev.2003.05.002>
- Wazlawick, R. (2013). *Engenharia de Software: conceitos e práticas*. Rio de Janeiro: Elsevier. Retrieved from <https://books.google.com/books?id=Qtg4VUkE0V0C&pgis=1>
- Yin, R. K. (2013). *Case study research: design and methods*. (5th ed.). Sage Publications.

# Factores Clave en la Gestión de Tecnología de Información para Sistemas de Gobierno Inteligente

Gina Paola Maestre Góngora\*<sup>1</sup>, Wilson Nieto Bernal<sup>1</sup>

**Resumen:** La dinámica actual de las ciudades establece nuevos retos para los sistemas de gobernanza pública. Un reto importante para los gobiernos es diseñar e implementar novedosas estrategias de interacción y comunicación con los ciudadanos, a través de las tecnologías, con el fin de lograr un mejoramiento en la prestación de servicios sostenible, eficaz y eficiente garantizando la integridad y la construcción de confianza para mejorar la relación de los ciudadanos con el estado y la implementación de iniciativas de gobierno inteligente es una de las estrategias validas en este contexto. Este artículo identifica, presenta y analiza los factores claves para la gestión de Tecnología Informática (TI) teniendo en cuenta los desafíos y retos actuales que afrontan los territorios al momento de trazar metas hacia una gobernanza inteligente.

**Palabras Clave:** Gobierno Inteligente, Gestión de Tecnología, Innovación, Ciudad Inteligente, Modelos Gestión de Tecnología

**Abstract:** The actual dynamic of cities establishes new challenges for public governance systems. An important challenge for governments is to design and implement innovative strategies of interaction and communication with citizens trough of the technology in order to achieve improvement in the delivery of sustainable, effective and efficient services by ensuring the integrity and building trust to improve the relationship between citizens with the state and the implementation of smart government initiatives is one strategy valid in this context. This article identifies, introduces and analyzes the key factors in the management of Information Technology (IT) taking into account the challenges and current challenges facing the territories when setting goals for smart governance.

**Keywords:** Smart Government, Management Information technology, Innovation, Smart City, IT Management models

Submitted: June 29th 2015 / Approved: December 1st 2015

## 1. Introducción

El concepto de territorio o ciudad inteligente ha ido tomando importancia y gran relevancia a la hora de trazar e implementar políticas públicas a nivel mundial dado el desarrollo y crecimiento poblacional de los centros urbanos. Estas ideas han ido tomando fuerza en la última década, por ello, están en evolución, siendo un concepto amplio y dinámico que en general está conformado por una compleja combinación e interacción de factores sociales, políticos, tecnológicos y económicos. Este concepto surge principalmente de la necesidad de racionalizar y optimizar mediante el uso de tecnologías los recursos y su disponibilidad, principalmente los recursos comunes entendidos como facilidades compartidas agotables susceptibles de sufrir dilemas sociales (infraestructura, agua, energía, entre otros) que presentan, como consecuencia de lo anterior, problemas que amenazan su disponibilidad, tales como: congestión, contaminación y sobreexplotación (Parra & Dyner, 2008)

La aplicación de las ideas de territorios o ciudades inteligentes sigue caminos muy variados dependiendo de políticas específicas, objetivos, financiación y alcance de cada territorio de acuerdo a su contexto particular, pero se aprecia que sus propósitos están orientados básicamente a dos ideas generales: mejorar la calidad de vida de los ciudadanos y el desarrollo sostenible de las ciudades como lo exponen (Dameri, 2013) (Caragliu, Del Bo, & Nijkamp, 2011) (Toppeta, 2010) y (Batty et al., 2012).

En este orden de ideas (Nam & Pardo, 2011) afirma que el objetivo de las ciudades inteligentes es crear un entorno para el intercambio de información, la colaboración, la interoperabilidad y experiencias perfectas para sus habitantes asumiendo la innovación tecnológica como un mecanismo para mejorar los servicios y crear condiciones donde las herramientas pueden ser mejor utilizadas; donde el uso de las tecnologías son indispensables para mejorar la competitividad y asegurar un futuro más sostenible por la relación entre personas, empresas, tecnologías, infraestructuras y gobierno. Las Tecnologías de Información (TI) son un elemento principal para ofrecer infraestructura, plataformas y soluciones, sin embargo no se puede asegurar una alta inteligencia y capacidad de solución a los problemas a menos que estén integradas a una arquitectura amplia de coordinación entre espacios físicos, institucionales y digitales de las ciudades.

Uno de los aspectos que caracteriza un territorio inteligente es el tema de gobernanza o gobierno inteligente donde se asume el objetivo de

<sup>1</sup> Facultad de Ingenierías. Universidad del Norte, Puerto Colombia, Colombia.

\*Corresponding author: ggongora@uninorte.edu.co



mejorar los servicios y la relación del gobierno con sus ciudadanos pero en el cual se afrontan retos crecientes asociados al componente tecnológico relacionados con la gestión, mantenimiento y mejoramiento de las infraestructuras tecnológicas y las políticas de innovación (Kominos, Schaffers, & Pallot, 2011). En este artículo se identifican y analizan algunos factores claves en la gestión de TI para un gobierno inteligente teniendo en cuenta los desafíos y retos actuales que afrontan los territorios al momento de trazar metas hacia una gobernanza inteligente. Estos factores serán un insumo inicial para la formulación de un modelo general para la gestión de tecnologías de información en un territorio o ciudad desde el contexto del gobierno inteligente.

## 2. Aproximación conceptual a ciudades inteligentes y gobierno inteligente.

Una ciudad inteligente se define según (Toppeta, 2010) como áreas geográficas que combinan las TIC y la tecnología Web 2.0 con otros esfuerzos de organización, diseño y planificación de desmaterializarse y acelerar los procesos burocráticos y ayudar a identificar nuevas e innovadoras soluciones a la complejidad de gestión de la ciudad, con el fin de mejorar la sostenibilidad y la habitabilidad. Por su parte (Caragliu et al., 2011) afirma que en una ciudad inteligente las inversiones en capital humano, en capital social y en las tradicionales (transporte) y modernas (TIC) infraestructuras de comunicación son el combustible sostenible del crecimiento económico y de una alta calidad de vida, con una gestión inteligente de los recursos naturales a través de la gestión participativa. Igualmente (Manville et al., 2014) expone que una ciudad inteligente busca abordar los asuntos públicos

a través de soluciones basadas en las TI sobre la base múltiples partes interesadas en asociación. No obstante ((Batty et al., 2012) plantea una ciudad es inteligente en la medida que son capaces de integrar y sintetizar estos datos para algún propósito, la forma de mejorar la eficiencia, la equidad, la sostenibilidad y la calidad de vida. Sobre la base de las consideraciones anteriores y de la literatura del tema, puede observarse que las ideas subyacentes al concepto de ciudades y territorios inteligentes están asociadas al uso de tecnologías, principalmente TIC, la mejora en la calidad de vida de sus habitantes y en la participación y la colaboración entre ciudadanos, gobierno y empresas.

Por otra parte, los enfoques para la concepción de estas ciudades o territorios se destacan el enfoque de innovación abierta-OI-(Schaffers et al., 2012), (Paskaleva, 2011) o el sistema de sistemas-SoS- (Naphade, Banavar, Harrison, Paraszczak, & Morris, 2011), (Harrison & Donnelly, 2011). Una definición simple de OI es un proceso de apertura de los límites para compartir e intercambiar conocimientos e información, es el modo de transformar colaborativamente para mejorar u obtener un nuevo producto o servicio, donde a partir de la confianza, se buscan y se comparten las soluciones. Por otra parte un SoS se caracteriza por un conjunto o arreglos de sistemas independientes unidos entre sí de varias maneras para proporcionar capacidades. La unión de los sistemas se puede adaptar para proporcionar capacidades deseadas, dependiendo de la situación. Una ciudad inteligente constituye un “sistema de sistemas” - un conjunto de sistemas públicos y privados interdependientes que la ciudad puede integrar y optimizar para lograr un nuevo nivel de eficacia y eficiencia. (Naphade et al., 2011).

En cuanto a las dimensiones o características de una ciudad inteligentes es de resaltar el aspecto de gobierno inteligente, el cual es una característica presente en las definiciones, así como en diferentes índices de clasificación y marcos de referencia como se aprecia en la Tabla 1, porque el gobierno es un actor que desempeña un papel fundamental para dirigir y coordinar esfuerzos e iniciativas de ciudades inteligente (T. Nam & Pardo, 2014). Según la (Unit, 2010) si bien las TI tienen el poder para hacer frente a los desafíos de la gobernanza de las ciudades -y con ello mejorar la calidad de vida de los residentes de la ciudad- el uso exitoso de las TI es mucho más que sólo la inversión en hardware y software; de igual forma (Schaffers et al., 2011) plantea que hasta ahora el papel de las ciudades y regiones en la innovación basada en las TI en su mayoría centrado en el despliegue de infraestructura de banda ancha, la estimulación de las aplicaciones basadas en TI que mejoran la calidad de vida de los ciudadanos se está convirtiendo en una prioridad clave.

Tabla 1. Características o dimensiones de las ciudades inteligentes.

Modelo/ Índice Ciudad Inteligente	Características o dimensiones de ciudades inteligentes
Smart cities Ranking of European medium-sized cities. (Giffinger et al., 2007)	Smart economy (competitiveness); Smart people (social and human capital); <b>Smart governance</b> (participation); Smart mobility (transport and ict) ; Smart Environment; Smart Living
IDC. Análisis de las ciudades inteligentes en España. (IDC, 2011)	<b>Smart Governance</b> ; Smart Buildings; Smart Mobility; Smart Energy and Environment; Smart Services
A framework for measuring smart cities (Priano & Guerra, 2014)	<b>Smart Government</b> (SG), Economy (Ec), Mobility (M), Environment (En), IoT, Connectivity (C) Urban Planning (UP).
Índice IESE cities in motion. (CGE, 2015)	Capital humano; Cohesión social; <b>Gobernanza</b> ;Economía; Gestión pública; Movilidad y transporte; Medio Ambiente; Planificación urbana; Proyección internacional; Tecnología
Cohen´s Smart Cities Wheel Model	Smart environment; Smart people; <b>Smart governance</b> ; Smart mobility ; Smart Living ; Smart Economy

En lo que se refiere a los propósitos de los gobiernos inteligentes (T. Nam & Pardo, 2014) supone que se espera aumentar la eficiencia, eficacia y transparencia en la gestión organizacional y entrega de servicios, promover la colaboración entre los departamentos de la ciudad con otras organizaciones externas y ciudadanos, facilitando así la participación de entidades no gubernamentales en la toma de decisiones y el seguimiento la prestación de servicios. De la misma forma (Eglé Gaulé, Jurgita, & Jolanta, 2015) expone que la gestión pública inteligente se define como la gobernanza que permite a un sistema social y sus sujetos operar eficazmente en un entorno dinámico y complejo utilizando racionalmente sus recursos internos y externos, la toma de decisiones adecuadas/pragmáticas y avanzadas relacionadas con las circunstancias específicas con el fin de crear valor compartido. Y en un concepto más conciso pero poderoso (Gil-Garcia, Helbig, & Ojo, 2014) plantea que un gobierno más inteligente parece requerir tener un enfoque con visión de futuro para el uso e integración de la información, la tecnología y la innovación en las actividades de gobierno.

Como resultado de las anteriores definiciones emergen características que pueden determinar la inteligencia en los sistemas de gobierno, tales como:

- Flexible, colaborativo, innovador, pragmático, dinámico, participativo y la creación de redes (E Gaulé, Šiugždinienė, & Buškevičiūtė, 2014)
- La eficiencia, la eficacia, la transparencia y la colaboración (T. Nam & Pardo, 2014)
- Información abierta, participación de los interesados y la colaboración, y mejora en las operaciones del gobierno. (Scholl & Scholl, 2014).
- La colaboración entre organizaciones, intercambio de información, la integración (Gil-Garcia, 2012).
- Normalización, la interoperabilidad, la integración, los datos abiertos y los datos compartidos (Correia, 2011; Schaffers et al., 2012; Schaffers et al., 2011)

### 3. Desafíos en la gestión de Tecnología Informática para el gobierno inteligente

Según (Neirotti, De Marco, Cagliano, Mangano, & Scorrano, 2014) las TI son una tecnología de uso general complementaria al capital humano y organizacional y cuyo uso está conformado por las decisiones políticas y por el ecosistema urbano de los ciudadanos, proveedores de tecnología y las autoridades locales, en función de las necesidades y hábitos de la ciudad. Algunos de los desafíos a los que se enfrentan los territorios inteligentes desde el componente del gobierno son:

- Enfocar la idea de la tecnología para que esté orientada a las necesidades concretas del ser humano, poniéndolo como punto de partida a él y sus necesidades, a un ciudadano con necesidades cambiantes, informado que requerirá nuevas soluciones y mecanismos para obtener más información y soluciones en tiempo real. (Branchi, Matias, & Fernandez, 2013)

- Elaborar las prioridades con respecto a la sociedad y aplicaciones económicamente deseables, basados en los objetivos estratégicos en materia de desarrollo económico y social de las zonas de la ciudad. (Komninos et al., 2011)
- Conectar los problemas y cuestiones reales y a los movimientos de base con el objetivo de empoderar a los ciudadanos y empresarios. (Schaffers et al., 2012)
- Las decisiones son impulsadas por el presupuesto que dirigidas por la estrategia. La tecnología puede habilitar o bloquear iniciativas inteligentes. La gestión de portafolios, la estrategia de articulación digital y la comunicación directa y la colaboración entre las empresas y la TI son requeridas. También la posición de la TI en relación con la ambición de ciudad inteligente debe aclararse.

Del mismo modo (Schaffers et al., 2012) identifica algunos cambios emergentes en el dominio de las ciudades inteligentes y sus ecosistemas de innovación tales como:

- Incremento en el despliegue en la infraestructura de banda ancha y creación de redes abiertas y repositorios abiertos.
- Participación creciente y empoderamiento de los ciudadanos en cuestiones sociales, usando social media y datos abiertos a una escala más amplia.
- Interés creciente para probar a gran escala servicios y soluciones p.e eficiencia energética, salud, monitoreo medio ambiente, movilidad.
- Diversidad de tecnologías para aplicaciones están disponibles rápidamente (móviles, computación en la nube, datos abiertos y dispositivos inteligentes).
- Usuarios orientados a la innovación abierta.

Como resultado de lo anterior se evidencia una necesidad de gestionar de manera más eficiente los recursos e infraestructura tecnológica de tal manera que esta se encuentre alineada a los objetivos estratégicos de los gobiernos y puedan administrarse de mejor manera los desafíos y cambios emergentes descritos anteriormente. (Mishra, 2013) asume que las aplicaciones y tecnologías de gobierno electrónico deben ser capaces de responder a las preguntas fundamentales de cómo funcionan las ciudades, la forma en que se organizan y cómo se puede hacer para trabajar de maneras más inteligentes para ciudadanos y empresas. Una ciudad inteligente será capaz de reunir a la tecnología, la información, y la visión política en un programa coherente de mejora urbana y de servicios. De acuerdo a (Chourabi, Nam, Walker, Gil-Garcia, & Mellouli, 2012) la gestión y la organización de un gobierno de la ciudad y su gobernabilidad con otros actores son factores clave en el éxito de iniciativas de ciudades o territorios inteligentes. Por ello la gestión de TI se entiende como el alineamiento estratégico de TI con la organización tal que obtenga valor agregado por medio del desarrollo y mantenimiento de un control y responsabilidades efectivas, gestión de desempeño y de riesgos. Desde la gestión de TI para el gobierno se busca establecer las estrategias para alcanzar los objetivos institucionales del gobierno centrado en el uso de las TI orientado a satisfacer las necesidades de los ciudadanos en los territorios inteligentes.

#### 4. Factores claves para una gestión de tecnología informática como soporte a un gobierno inteligente

Para que una ciudad o un territorio y en particular un gobierno puedan alcanzar la condición de inteligente no dependerá única y exclusivamente de superar el factor tecnológico o de infraestructura, sino que el éxito de estas iniciativas por lo general es el resultado de una combinación compleja de otros factores: sociales, políticos, económicos, humanos y organizacionales.

En particular para afrontar el tema de gestión de tecnología en contextos de gobiernos inteligentes todos los factores mencionados anteriormente son relevantes, pero en este trabajo se partirá de una situación de interés que se concibe desde el concepto de arquetipo sistémico mediante el cual se ilustra cómo algunos factores emergen y sus relaciones pueden ser claves para comprender los problemas asociados a la gestión de TI en un gobierno inteligente (Figura 1)

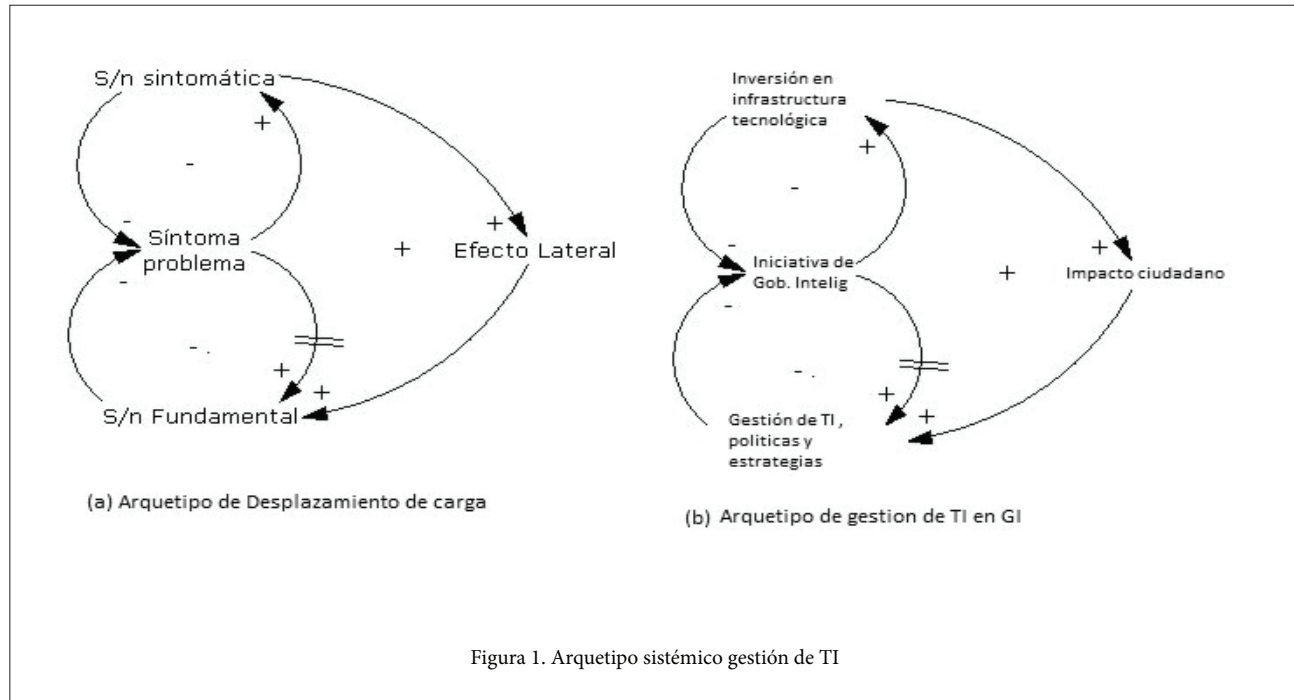


Figura 1. Arquetipo sistémico gestión de TI

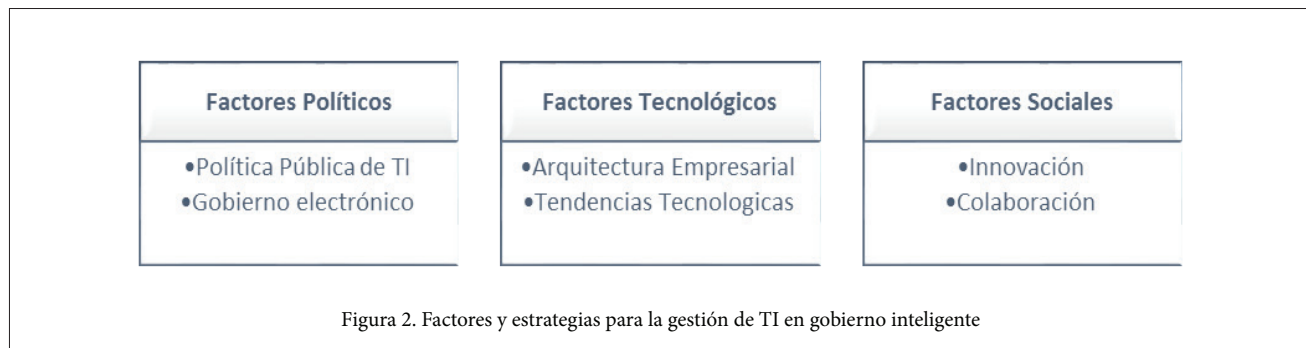
Un arquetipo describe patrones de comportamiento de un sistema, son situaciones que se repiten permanentemente, generando errores en el comportamiento de una organización (Senge, 2005). El arquetipo de desplazamiento de carga suele comenzar con un síntoma que insta a alguien a intervenir para resolverlo, en este caso asumiremos el síntoma como las diversas iniciativas de gobierno inteligente para ello se plantea una solución sintomática que es evidente e inmediata, y que pronto elimina el síntoma, como lo es la inversión en infraestructura tecnológica, la cual por lo general es desmedida, no planeada y centrada en los artefactos tecnológicos. Esta es una solución de corto plazo para corregir el problema, con resultados inmediatos aparentemente positivos, entre más infraestructura tecnológica disponible para mejorar la gobernanza, se asume la condición de gobierno inteligente.

Esta solución desvía la atención respecto del problema real o fundamental, que sería una estrategia de gestión de tecnología guiada por una política pública que pueda orientar mejor el logro de objetivos

de un gobierno inteligente, esta solución fundamental a menudo se debilita cuando se le presta menos atención y se cree que la solución inmediata en este caso la infraestructura es la que puede resolver definitivamente el síntoma, porque a medida que esta solución se refuerza positivamente, las fundamentales se aplican menos y con el tiempo se crea dependencia respecto a la solución sintomática. Las anteriores soluciones necesariamente conllevan a efectos laterales que en este caso es el impacto en los ciudadanos. Además es importante considerar los retardos presentes en cada uno de los ciclos en los cuales es evidente que la demoras en el ciclo de la inversión de tecnología, es menor que la de gestión de TI y la mayor demora se evidencia en el impacto en el ciudadano, es decir la velocidades en que cada uno los ciclos se van ejecutando, es una característica que afecta considerablemente la estabilidad del sistema.

Partiendo de la situación anterior se asumen en particular tres factores claves y algunas estrategias para la gestión de TI en gobierno inteligente como se aprecia en la Figura 2.





El *factor político* el cual puede impulsar mediante la formulación de políticas públicas de TI y gobierno electrónico la planeación y sostenibilidad del gobierno inteligente a largo plazo, el *factor tecnológico* orientado no hacia los artefactos o tendencias tecnológicas únicamente sino hacia la implementación de arquitecturas empresariales de TI que posibilitan la implementación de estos artefactos y tendencias tecnológicas, cambiantes y dinámicas, en el marco de una política pública alineada con el marco legal y operativo que rige a las entidades del sector público para disminuir el riesgo de fracaso

de los proyectos de TI del gobierno. Por último el *factor social* en el cual teniendo en cuenta que el objetivo de la gobernanza inteligente es la eficiencia y eficacia en los servicios del gobierno también lo es el mejoramiento de la relación con los ciudadanos y la satisfacción en la interacción con el gobierno; por ello en este factor se contemplan las estrategias de innovación y colaboración para promover y motivar nuevas relaciones ciudadano- gobierno. A continuación en la Tabla 2 se describen las estrategias asociadas a cada uno de los factores.

Tabla 2. Descripción factores clave en gestión de TI de gobierno inteligente

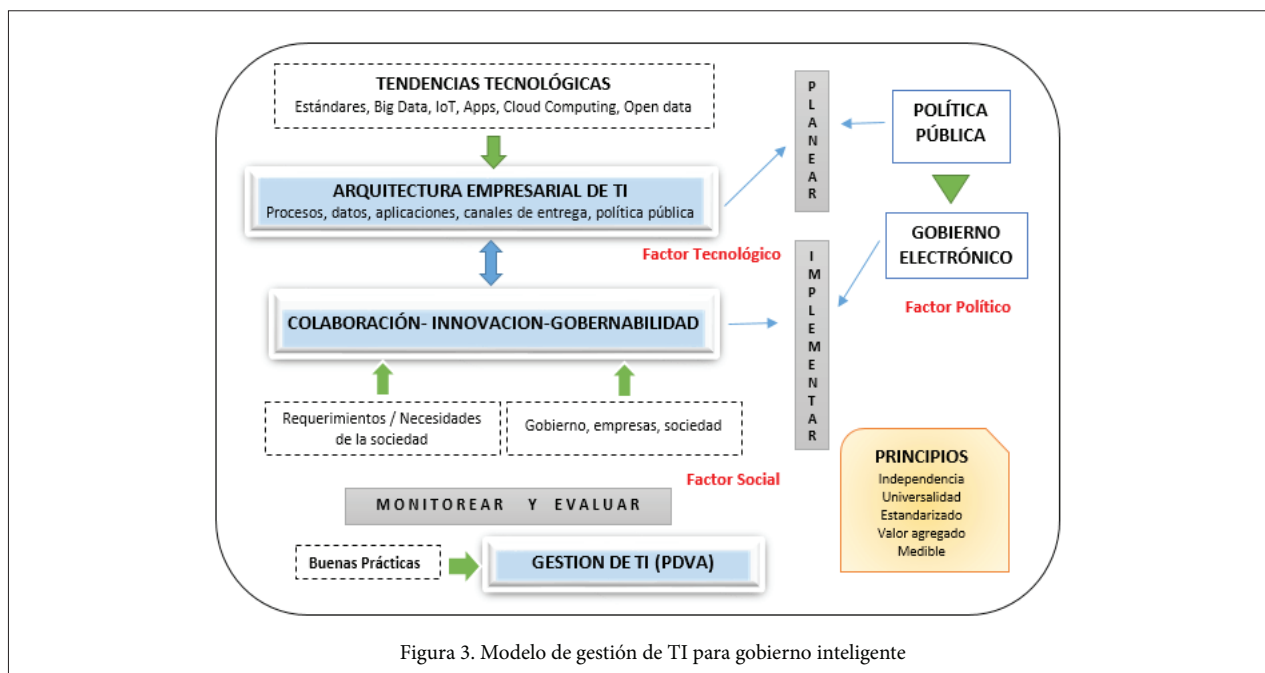
Factor	Estrategia	Descripción
Politico	Política pública de TI	Las políticas públicas de TI son un ingrediente fundamental para el éxito de un gobierno inteligente. El cierre de la brecha digital y el aumento significativo en el acceso de las TI plantea un desafío importante en materia de políticas públicas, por su carácter dinámico, que obliga a un constante ajuste de sus objetivos, en la medida que surgen nuevas tecnologías. Las agendas de política digitales son necesarias pues se constituyen en una plataforma de coordinación de esfuerzos a largo plazo, por lo general dispersos. Puesto que los sectores económicos y sociales incorporan las TIC de forma asincrónica y diferente, es posible que se desarrollen iniciativas y proyectos con iguales objetivos en distintos sectores, lo cual genera focos de ineficiencia que se traducen en duplicación de tareas y derroche de recursos.(Guerra & Jordán, 2010)
	Gobierno Electrónico	El gobierno electrónico se entiende como la entrega de servicios mediante el uso de las TI para facilitar transformar y promover de relación entre el estado y los ciudadanos, además de aumentar la eficiencia, transparencia, accesibilidad y capacidad de respuesta a los ciudadanos en la gestión interna del sector público. Para (Criado & Gil-García, 2013) las repercusiones o beneficios del e-gobierno no son la consecuencia exclusiva de la utilización de tecnologías de información. El e-gobierno también implica una construcción política y organizacional que requiere una atención a factores muy diversos ya que la interacción entre tecnologías y administraciones públicas es compleja por ello la necesidad de entender esta complejidad en los procesos de adopción y uso de las TI implica considerar cuestiones que normalmente no se tienen en cuenta a la hora de aproximarse al e-gobierno. Es de anotar que un desarrollo significativo en gobierno electrónico es importante para la implementación de iniciativas de gobernanza inteligente, su implementación por sí sola no se traduce en gobiernos inteligentes.

Tecnológico	Arquitectura Empresarial	Con el fin de mejorar y garantizar que las inversiones en tecnología y servicios para los ciudadanos y la mejora de los procesos de las entidades públicas y la construcción de gobiernos inteligentes se han comenzado a usar arquitecturas empresariales que actúan como una especie de hoja de ruta para el diseño, desarrollo y adquisición de sistemas de información complejos que den soporte a los objetivos misionales de los gobiernos. El futuro de EA en programas de gobierno debe proporcionar una visión integral y coherente en todo negocio, información y tecnología; no sólo para guiar el diseño de sistemas de TI sino para entregar el cambio del negocio apoyado y facilitado por las TI (Hjort-Madsen & Pries-Heje, 2009). Los esfuerzos actuales en cuanto a gobierno electrónico es que sean orientados a gobiernos inteligentes para lo cual es necesario la gestión y coordinación de los proyectos y proporcionar marco de referencia para explicar las relaciones entre los proyectos y la gestión de cambio dentro de la administración pública la cual es vista como visto como una colección de un gran número de organizaciones heterogéneas que tienen diferentes procesos de negocio y sistemas de información pero con necesidades de compartir información, interoperabilidad y datos abiertos entre otras características propias de los gobiernos inteligentes.
	Tendencias Tecnológicas	La dinámica de desarrollo y avance de las tecnologías de información facilitan la emergencia de características que deben estar presentes en el contexto de gobierno inteligentes: interoperabilidad, datos compartidos, disponibilidad, innovación son algunas de las más importantes y que sin estas no podríamos considerar un gobierno inteligente. Por ello las tendencias tecnológicas actuales que el gobierno y las organizaciones deben tener en cuenta para los procesos de planificación estratégica y el desarrollo de las ciudades y gobiernos inteligentes y que facilitan la presencia de estas características desde el componente tecnológico son: Big Data, IoT (Internet de las cosas), los datos abiertos, Apps (aplicaciones móviles) entre otras.
Social	Innovación	La innovación en el gobierno está relacionada con ideas novedosas para prestar servicio, generalmente orientada a cambios organizacionales y en generación de nuevas políticas para proveer servicios pertinentes, accesibles, eficientes y oportunos a los ciudadanos. La innovación desde los gobiernos inteligentes pueden ser: servicios nuevos o mejorados, nuevas estrategias y procesos en la prestación y entrega de los servicios, innovación organizacional, entre otras.
	Colaboración	El objetivo de la colaboración es el intercambio de información para generar y capitalizar sinergias entre las partes interesadas facilitando la construcción de soluciones conjuntas e innovadoras. Una capacidad de colaborar permite a la administración públicas ser más consiente y sensible a las necesidades del gobierno y del ciudadano.

## 5. Modelo de gestión de TI para gobierno inteligente

Con los factores descritos anteriormente, se formula un modelo inicial de gestión de TI que se concibe como un sistema donde inter-

actúan los siguientes elementos: tendencias tecnológicas, principios y tres componentes principales: arquitectura empresarial, servicios de colaboración y gestión de tecnología.



Inicialmente el modelo está marcado por una serie de tendencias tecnológicas que conforman un territorio inteligente, las tecnologías emergentes como Big data, Internet de las Cosas (IoT), cloud computing, son entre otras las que han jalonado el desarrollo de las organizaciones públicas, como también el interés de la comunidad por conocer de primera mano cómo se llevan a cabo los procesos públicos en un contexto de transparencia, eficiencia, productividad y sostenibilidad. Así mismo el modelo está guiado por unos principios que son un conjunto de enunciados expresados en forma de reglas de alto nivel, que guían y permiten tomar decisiones sobre una base sólida como son: Separar el gobierno y gestión (independencia); Gestión Amplia (universalidad); Adoptar estándares (estandarizada), Generar Valor y Medir el desempeño (medible).

En el componente de arquitectura empresarial se localizan las capacidades tecnológicas del contexto (ciudad, región, localidad), regularmente desplegada en las diferentes instituciones u organismos (alcaldías, ayuntamientos, departamentos, agentes de seguridad entre otras) en forma específica está representada por el modelo de ciudad desde el punto de vista del ordenamiento, los procesos y servicios públicos de cara al ciudadano, los procesos core asociados al contexto, las aplicaciones, la data (base de datos, Bodegas de Datos, repositorios en general), la infraestructura hardware, software, la networking y los diferentes contratos de servicios.

El componente de los servicios de colaboración son ambientes que permiten el acceso a contenidos de información de parte de los usuarios o ciudadanos, organizaciones, empresas y en general la sociedad, que a través de diversos canales de entrega (Web, Móvil) crean espacios de interacción a través de redes sociales y espacios de discusión.

Y finalmente el componente de Gestión de Tecnología Informática visto este como el escenario para planificar, construir, ejecutar y controlar actividades alineadas con la dirección establecida por el cuerpo de gobierno y de esta forma alcanzar las metas empresariales. La aplicación efectiva de la gestión tecnológica informática permite entre otros aspectos:

- Mantener información de alta calidad para soportar las decisiones de las organizaciones públicas asociadas a los territorios inteligentes.
- Generar valor a las instituciones y por ende a los ciudadanos en general, haciendo las inversiones de TI, dentro de un marco de planeación estratégica adecuada por ejemplo, alcanzando metas estratégicas y generando beneficios a través de un uso de las TI de forma eficaz e innovadora.
- Contribuye a alcanzar la excelencia operacional a través de una aplicación de la tecnología fiable y eficiente.
- Permite mantener los riesgos relacionados con TI en un nivel aceptable, controlado y mitigando el impacto de los mismos en el momento en que se presenten
- Optimizan el coste de los servicios y tecnologías de TI
- Y tal vez lo más importante en el contexto de las organizaciones públicas cumpliendo con las constantemente crecientes leyes, regulaciones, acuerdos contractuales y políticas aplicables.

## 6. Conclusiones

El gobierno inteligente es un concepto amplio y que abarca el uso intensivo de las tecnologías de información para generar una transformación en los procesos de la administración pública con el fin de mejorar las relaciones con sus ciudadanos a través de la colaboración y la innovación. Cada día se aprecia la emergencia de iniciativas hacia gobernanzas inteligentes, iniciativas que se enfrentan a desafíos debido a la complejidad de los factores (sociales, económicos, tecnológicos, organizacionales) que en ellas intervienen y debido a esta complejidad no hay un consenso general en relación a lo que implica un gobierno inteligente y sus características por lo cual podemos afirmar que cada iniciativa se ajusta al contexto particular de aplicación.

Con el avance de las TI, estas cada vez pueden ofrecer mejores y mayores facilidades (big data, cloud computing, open data) a los gobiernos para innovar en la prestación de servicios, pero estas también traen asociados unos riesgos y desafíos que pueden impedir que los objetivos de eficiencia, transparencia y colaboración se puedan alcanzar a largo plazo, de una manera sostenible y en la cual la tecnología es un catalizador importante para el éxito de estas iniciativas.

Es necesario que exista una alineación estratégica de las TI con los objetivos de la administración pública mediante modelos de gestión aplicados a contextos de territorios inteligentes. Factores políticos, sociales y económicos y estrategias como arquitecturas empresariales, servicios de colaboración, política pública de TI y gobierno electrónico junto a las tendencias tecnológicas hardware y software gestionados adecuadamente pueden proveer un camino más eficaz hacia la construcción de gobernanzas inteligentes, donde la arquitectura empresarial es un elemento fundamental para la gestión por que brinda una visión integral y coherente del gobierno basado en información y tecnología; no sólo para guiar el diseño y la implementación sino para facilitar el cambio generado por las TI en la sociedad y el impacto en los ciudadanos. Existen muchos otros factores que también pueden tenerse en cuenta explícitamente en futuros modelos como los económicos, organizacionales y culturales que seguramente darán más complejidad y completitud a la hora de promover la gestión de tecnología en gobiernos inteligentes.

## Agradecimientos

Al Departamento Administrativo de Ciencia, Tecnología e Innovación- COLCIENCIAS por el apoyo para el desarrollo de la tesis "Framework para la gestión de tecnología en ciudades inteligentes colombianas" del programa de Doctorado en Ingeniería de Sistemas y Computación de la Universidad del Norte en marco de la beca de estudios Doctorados Nacionales 2012.

## Referencias

Batty, M., Axhausen, K. W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., . . . Portugali, Y. (2012). Smart cities of the future. *European Physical Journal-Special Topics*, 214(1), 481-518. doi:10.1140/epjst/e2012-01703-3

- Branchi, P., Matias, I., & Fernandez, C. (2013). City & technology: An analysis matrix to serve citizens. Paper presented at the International Conference on New Concepts in Smart Cities: Fostering Public and Private Alliances (SmartMILE), Gijón.
- Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart Cities in Europe. *Journal of Urban Technology*, 18(2), 65-82. doi:10.1080/10630732.2011.601117
- CGE, C. d. G. y. E. (2015). Índice IESE cities in motion. Retrieved from <http://citiesinmotion.iese.edu/indicecim/>
- Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J., & Mellouli, S. (2012). Understanding Smart Cities: An Integrative Framework. Paper presented at the 45th Hawaii International Conference on System Sciences, Hawaii.
- Correia, L. M. (2011). Smart Cities Applications and Requirements. White Paper. Retrieved from [http://www.networks-etp.eu/fileadmin/user\\_upload/Publications/Position\\_White\\_Papers/White\\_Paper\\_Smart\\_Cities\\_Applications.pdf](http://www.networks-etp.eu/fileadmin/user_upload/Publications/Position_White_Papers/White_Paper_Smart_Cities_Applications.pdf)
- Criado, J. I., & Gil-García, J. R. (2013). Gobierno electrónico, gestión y políticas públicas: Estado actual y tendencias futuras en América Latina. *Gestión y Política Pública*, 15(2), 259-305.
- Dameri, R. P. (2013). Searching for Smart City definition: a comprehensive proposal. *International Journal of Computers & Technology*, 11(5), 2544-2551.
- Gaulé, E., Jurgita, Š., & Jolanta, S. (2015). Smart Public Governance: dimensions, characteristics, criteria. Paper presented at the International Research Society For Public Management Conference, Birmingham, London. Retrieved from <http://irspm2015.com/sppa/index.php/irspm/IRSPM2015/paper/viewFile/1286/582>
- Gaulé, E., Šiugždinienė, J., & Buškevičiūtė, J. (2014). The Need of Smartness in Public Governance, 2014. Paper presented at the Proceedings of the 8th Scientific Conference "Business and Management 2014."
- Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N., & Meijers, E. (2007). Smart cities-Ranking of European medium-sized cities. Retrieved from [http://www.smart-cities.eu/.../smart\\_cities\\_final\\_report.pdf](http://www.smart-cities.eu/.../smart_cities_final_report.pdf)
- Gil-Garcia, J. R. (2012). Towards a smart State? Inter-agency collaboration, information integration, and beyond. *Information Polity*, 17(3-4), 269-280. doi:10.3233/IP-2012-000287
- Gil-Garcia, J. R., Helbig, N., & Ojo, A. (2014). Being smart: Emerging technologies and innovation in the public sector. *Government Information Quarterly*, 31(S1), I1-I8. doi:10.1016/j.giq.2014.09.001
- Guerra, M., & Jordán, V. (2010). Políticas públicas de Sociedad de la información en América Latina: ¿una misma visión? Retrieved from <http://www.cepal.org/es/publicaciones/3757-politicas-publicas-de-la-sociedad-de-la-informacion-en-america-latina-una-misma>
- Harrison, C., & Donnelly, I. A. (2011). A theory of smart cities. Paper presented at the Proceedings of the 55th Annual Meeting of the ISSS-2011, Hull, UK.
- Hjort-Madsen, K., & Pries-Heje, J. (2009). Enterprise Architecture in Government: Fad or Future? Paper presented at the 42nd Hawaii International Conference on System Sciences, 2009. HICSS'09., Hawaii.
- IDC. (2011). *Análisis de la ciudades inteligentes en España*. White Paper, available. Retrieved from [http://www.socinfo.es/contenido/seminarios/1404smartcities6/02-IDC\\_Smart\\_City\\_Analysis\\_Spain\\_2012.pdf](http://www.socinfo.es/contenido/seminarios/1404smartcities6/02-IDC_Smart_City_Analysis_Spain_2012.pdf)
- Komninos, N., Schaffers, H., & Pallot, M. (2011). Developing a policy roadmap for smart cities and the future internet. Paper presented at the eChallenges e-2011 Conference Proceedings, IIMC International Information Management Corporation.
- Manville, C., Cochrane, G., Cave, J., Millard, J., Pederson, J. K., Thaarup, R. K., . . . Kotterink, B. (2014). Mapping Smart Cities in the EU. Retrieved from [http://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/507480/IPOL-ITRE\\_ET\(2014\)507480\\_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/507480/IPOL-ITRE_ET(2014)507480_EN.pdf)
- Mishra, M. K. (2013). Role of Technology in Smart Governance: 'Smart City, Safe City'. Retrieved from doi:<http://dx.doi.org/10.2139/ssrn.2310465>
- Nam, T., & Pardo, T. A. (2011). Conceptualizing smart city with dimensions of technology, people, and institutions. Paper presented at the Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times.
- Nam, T., & Pardo, T. A. (2014). The changing face of a city government: A case study of Philly311. *Government Information Quarterly*, 31(SUPPL.1), S1-S9. doi:10.1016/j.giq.2014.01.002
- Naphade, M., Banavar, G., Harrison, C., Paraszczak, J., & Morris, R. (2011). Smarter cities and their innovation challenges. *Computer*, 44(6), 32-39.
- Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current trends in Smart City initiatives: Some stylised facts. *Cities*, 38(0), 25-36. doi:<http://dx.doi.org/10.1016/j.cities.2013.12.010>
- Parra, J. A., & Dyner, I. (2008). Cooperación, expectativa y racionamiento en dilemas sociales de recurso de gran escala. *Revista de dinámica de sistemas*, 4(2).
- Paskaleva, K. A. (2011). The smart city: A nexus for open innovation? *Intelligent Buildings International*, 3(3), 153-171. doi:10.1080/17508975.2011.586672
- Priano, F. H., & Guerra, C. F. (2014). A framework for measuring smart cities. Proceedings of the 15th Annual International Conference on Digital Government Research, 44-54.
- Schaffers, H., Komninos, N., Pallot, M., Aguas, M., Almirall, E., Bakici, T., . . . Fernandez, J. (2012). Smart cities as innovation ecosystems sustained by the future internet.
- Schaffers, H., Komninos, N., Pallot, M., Trousse, B., Nilsson, M., & Oliveira, A. (2011). Smart cities and the future internet: Towards co-operation frameworks for open innovation: Springer. Retrieved from <https://hal.inria.fr/hal-00769635/document>

Scholl, H. J., & Scholl, M. C. (2014). Smart Governance: A Roadmap for Research and Practice. Retrieved from [https://www.ideals.illinois.edu/bitstream/handle/2142/47408/060\\_ready.pdf?sequence=2](https://www.ideals.illinois.edu/bitstream/handle/2142/47408/060_ready.pdf?sequence=2)

Senge, P. M. (2005). La quinta disciplina en la práctica: Ediciones Granica SA.

Toppeta, D. (2010). The smart city vision: how innovation and ICT can build smart, "livable", sustainable cities. Retrieved from <http://www.thinkinovation.org/file/research/23/en/Toppeta-Report-005-2010.pdf>

Unit, E. I. (2010). ICT for City Management: Using Information and Communications Technology to Enable, Engage and Empower City Stakeholders: a Research Project. Retrieved from [http://www.economistinsights.com/sites/default/files/Siemens\\_Reports\\_2010\\_FINAL%20TO%20PRINT.pdf](http://www.economistinsights.com/sites/default/files/Siemens_Reports_2010_FINAL%20TO%20PRINT.pdf)