

## **PROPOSED METHODOLOGY FOR MEASURING INNOVATION CAPABILITIES IN A NUMBER OF COMPANIES AGROBUSINESS**

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### **ABSTRACT**

This article is result of a project associated with the "Proposed methodology for measuring innovation capabilities in a number of agribusiness companies. Initially, it was carried out in the agribusiness sector and in diverse models of technological innovation capabilities. Once the similarities of the analysed models were identified, expert consultation and focus groups were approached with the objective of determining the capabilities and how they would be measured, having a result, a group of characteristic of the technological innovation capabilities and its indicators. Following, a framework containing the indicators was developed to measure the technological innovation capabilities. Finally, a pilot test was implemented in an agribusiness company of the sector, which in turn helped validate the tool designed.

**Key words:** Capacities, Framework, Innovation.

### **INTRODUCTION**

According to (Briones & Laborda,2010) "Currently, activities of Research and Development (R&D) are some of the main principals of business production growth. However, numerous of empirical studies reflect the great difference between businesses when it comes to benefitting from innovative activities". That is why each organization adapts various forms of work which in turn generate numerous and different abilities to compete in a world that every day looks more saturated with new products, which engenders a high competition and forces companies to provide better quality in the final product.

The capacities of technological innovations therefore transform according to (Lugones et al. ,2007) into "... the broader skills required to initiate an improvement process leading to a growth path and sustainable development, which implicates knowledge and abilities to acquire, use, absorb, adapt, improve and generate new technologies'. This is how a differentiator from competition is achieved, with the effort to win or survive in a market that is increasingly changing and unstable.

This paper shows the construction process for measuring innovation capabilities in businesses of goods and services; therefore contributing to the development of leaders in the innovation community, supported with a tool for refinement and the specifications of components for a correct measurement of innovation in the industry.

To show evidence of this contribution, a quantitative study was conducted at a sectorial diagnosis level, about the innovation components of the agribusiness sector in the department of Antioquia,

consultation of experts and focus groups were needed to determine the capacities of the elements in the proposal and the measuring method; then, a tool was developed to support the above and in addition it needed to be applicable to agribusinesses through a pilot test for establishing conclusions and future work.

In this sense, the present article is organized in the following way: in the first part, description of main antecedents, followed by the results of preliminary level of diagnosis, then the description of the proposed tool and finally the results of the pilot test applied to the application of the tool with its conclusions.

## **BACKGROUND**

### **Conceptual Background**

#### *About innovation*

According to (OCDE, 2005) “innovation is... the translation of a new, or significantly improved product (good or service), of a process, of a commercialization method or of a new organizational method, in the internal practices of a business, the organization of a workplace or external relationships”; in this sense they are considered real innovations only when they are introduced to the market and accepted. Meanwhile, innovative activities correspond to all the scientific, technological, organizational, financial and commercial operations that are conducted effectively, or that have as object to conduct the introduction of innovations. Some of these activities are innovative themselves; others are not new but are needed for the introduction of innovations. According to (OCDE, 2005) , innovation activities also include R&D that is not directly linked to the introduction of a particular innovation.

On the other hand, according to (Robledo, 2010) , a highlight of innovation is that it has had great advances through time, therefore having a big impact in the industry, facilitating the interaction of generation processes and implementation of the creative scientific and technological knowledge, thus making the use of innovation a strong element to capture the potential market.

#### *About the capabilities of innovation*

According to (Funes & Hernández, 2001) to determine the possible technological innovation capacities in the agro-industrial sector, it is necessary to establish as foreground some of the studies made in other countries, this is due to the fact that the Colombian industry does not have a good amount of case studies, therefore, variables that contained a greater relation and adaptability to the Colombian context were analyzed, in order to attain a measurable approximation of them.

In this regard, it is important to state that technological innovation capacities must be analyzed throughout the productive chain of the business, since they are not only referred to the product or service, but also to all critical areas that intervene directly with the fabrication, commercialization, organization, planning, strategy, learning and assignation of resources (Yam et al, 2004) ; this means that all areas have distinguishing features that can determine if they are leaders and innovators within the business; these set of characteristics allow to determine the innovative capabilities that a business has in order to confront the current market, that changes every day and requires a greater capable response to the demand.

## SECTORIAL DIAGNOSIS

Within this document, we have developed a sectorial characterization proposal following the bellow methodological approach:

The process of recollection of information and the treatment of the same was based on an approximate 50% random sampling equivalent to 13 companies of a specific population in the database of 26 companies in the area.

The analysis process of information was initially performed in a descriptive form with the aim to identify initial characterization elements with respect to a Technology Profile and an Innovative Profile developed by the methodology proposed by [8].

Presenting the following behaviors:

Regarding the Technology Profile Factor, the agribusiness companies are characterized for:

- In the past three years, they have acquired mostly key type technology (one that the company controls perfectly and that allows the company to keep a dominating position against the competition).
- Has incorporated technology mainly to the top hub.
- Transversal technology implemented mainly from assisting fairs specialized in/or technical assistance and/or consulting in areas like: biotechnology, new machinery and equipment designs, new products and/or services designs.
- Have preventive – predictive maintenance programs for machines and tool.
- Technical modalities of production and or services contribute mainly to generate innovation in processes.
- The Know How is used occasionally to train personnel to apply it within the company.
- Applied changes in technology have contributed significantly in productivity.
- Technology management exists and it is aligned along with the strategic plan of the companies.
- They are constantly informed of trends via journals focused on the area and make an effort to keep up with the toughest competition.
- 0 to 25% of the employees are trained in technology management.
- In the last three years they have implemented norms like: ISO 9000, ISO 14000, and others.
- The key technology has contributed to the increase in percentage of sales, and the acquired transversal technologies have contributed slightly to profitability.
- Software acquired in the last three years has not contributed to the increase in percentage of sales.
- Have invested in postgraduate studies and / or advanced technology training courses for their employees, with no evidence of costs assigned.

- Investments in management technologies have significantly contributed to profitability.
- With respect to the Innovative Profile factor, companies of the agribusinesses sector are characterized by:
- Have generic and or competitive strategies.
- Have organizational resources assigned to planning and administrative processes with a budget assigned.
- Do not plan or have processes in innovation training, even though they plan technological innovative objectives, they are not integrated to the business planning.
- Do not implement advanced technique in management that includes any significant change in the organizational structure.
- Depending only on the source of origin at the management level, they have a structured communication process that promotes the creation of new ideas.
- Consider that (internal and external) diffusion is a necessity in order to facilitate the enrichment or feedback of ideas at the innovation level.
- There is no type of relationship between the agents of the Sistema Nacional de Innovación (national system of innovation) with regards to the interaction of innovation activities, investigation and technological development.
- More than 75% of the employees have a level of education bellow third level (elementary and middle and high school). 25% remaining have a level of education above third level (Technical, graduate, bachelors, postgraduate).
- There is an independent interaction between the company, the clients and the providers in the development of new projects.
- The personnel is not directly linked to the development of new ideas that implicate innovative creativity or spirit, therefore there is no investment in creativity development or innovative spirit for the employees.
- They have an I+D department concentrated on objectives related to activities from other areas of the company.
- They have an investment plan for costs regarding innovative projects. In turn, they remain informed and implement regularly different mechanisms and financial possibilities for development of projects and innovation.
- They do not count with a model or methodology for planning and development of new products and/or services.
- Administrative services, innovation planning and technological development are associated to production processes and service providers, and the commercialization and acquisition processes of raw materials and supplies.
- Planning processes for the development of a new product involves areas like: production, market, R&D and quality control or QC.

- New product development strategy (NPD) maintains consistent communication with other companies through benchmarking.
- They do not have a communication system to evaluate results obtained from innovations of products and services.
- Invest only 0 to 1% of sales on experimental Research and Development R&D, However, there is a budget intended to the execution of fully running prototypes and to conducting pilot tests.
- The company has a budget for the launch of new products related to: publicity, training, and other key factors in order to obtain great diffusion of new products.
- They train only when necessary thus never include creativity as an added value.
- They conduct random market studies before launching new products/ services; the technical department (R&D, production, QC) receives informal feedback procedures about market behavior.
- The company has market strategies of sales that are monitored weekly to identify action plans.
- They do not involve innovation in their marketing and commercialization processes.
- They have created new markets and/or increase in client fidelity due to innovations in their products and/or services.
- Their portfolio has great potential, however it requires great attention in order to obtain significant market participation.
- Products respond to market demands and/or suggestions from clients.
- They do not have a system design to receive suggestions of new possible developments of products and/or processes.
- They do consider all suggestions (Complaints), replying to customers and carrying out internal corrective or preventive actions.
- They do not have follow-ups with consumers after sale.
- The company is currently involved in developing a website.
- Invest in test systems of products before going out to the market, following different stages.
- Only 0 to 25% of the suggestions received from clients, suppliers and employees are implemented in the development of new products and/or services and/or processes.
- Although there has been an attempt to plan new ideas, only ideas considered functional are implemented.
- All new processes are planned, thus have mainly innovated in processes belonging to areas such as administration, productions and services.
- Within Macro-processing of innovation, the most managed processes are the knowledge management, creativity, and human talent

- Patenting is not considered, since it has never been implemented.
- High levels of education (mayor, masters, PH) have contributed from 0 to 25% to the creation of innovations.
- Involve groups to develop projects with lightweight structures, (personnel assigned to these type of groups are physically present in their own functional areas, however, each functional organization assigns a worker to “present it” to the committee responsible for coordinating the project. This “representative” works with the “ lightweight project leader” who is typically a design engineer or a product-marketing manager, who is in charged of the performance and activities.
- When it comes to Research and Development, investment has been pointed to basic innovations.
- In cost associated objectives for technological development and innovations, they are mainly focused on: cost reduction of raw materials and decreasing physical supplies required per unit of product (service) or for implementation of new materials.
- Have invested on technological innovation (product and process), with the aim of: increasing the quality of products and the perceived value of it, reflected in a social and economic impact for the client and the business.

## TOOL CONSTRUCTION

The contextual framework, and the capabilities of innovation linked to the functional areas of the value chain and the activities of Research and Development (R&D), served as a starting point for the development of the present work. The experts’ consultation and the focal groups in the methodological developed identified these capabilities: capacities of R&D (presence of multidisciplinary work groups, level of integration of different functional groups, average number of active projects per year, quality and availability of leading brands (% of new product revenue per semester), Implementation of new advanced design methods (i.e reengineering), Technology transfer mechanisms from research on development, level of feedback from clients and market during innovation process.)

Which have been implemented in the tool trough the following interface:



Figure 1: Module for innovation capacities

Learning capacities (Capacity to evaluate relevant technologies of the company’s strategy, Assimilate knowledge obtained, Learn from experiences and Pass on learned experiences overcoming time and barriers).

Which have been implemented in the tool through the following interface:



Figure 2: Module for learning capacities

Marketing Capacities (Product Launching, Attesting feasibility with real world clients and Continued evaluation of market potential).

Which have been implemented in the tool through the following interface:



Figure 3: Module for marketing capacities

The tool is intended to perform a statistical analysis of the innovation capabilities of an organization.

Initially the tool displays an interface menu where the different options appear, as shown on the following chart.



Figure 4: Tool of menu options

The diagnosis option is the most prominent alternative where general information from the company is introduced; here the "Basic capacities diagnosis" evaluates people, technology, and space as shown on the following figure.

Figure 5: Module of basic diagnosis of capacities

The innovation capacities option has access to previous modules via the interface shown on the following figure.

Figure 6: Module for capacities selection

Finally, the Results option is intended to resume the information obtained from the tool and the indicators report as shown on the following figures.

DIAGNOSTICO						
Personas	Cantidad	Tiempo (Horas a la semana)	Inversion En	Cantidad	Espacio	Cantidad

Figure 7: Reports Module

DIAGNOSTICO	CAPACIDAD DE I+D		CAPACIDAD DE APRENDIZAJE		CAPACIDAD DE MARKETING	
	Indicador	Valor	Indicador	Valor	Indicador	Valor

Figure 8: Indicators Module

## CASE STUDY

The tool has been implemented in a company of the agribusiness sector, clarifying valid criteria in order to apply it in a series of companies of the area. The company where it has been applied, works in the area of production and commercialization of agribusiness' products; obtaining the following results:

Figure 9: Basic diagnostic module for the company

Based on the information reported, the individuals involved in the processes are: a technician, a technologist, two professionals, and a specialist; these people are in charge of carrying out all projects of technological innovation within the company. \$2.500.000 (local currency) is intended for investment in “technology”, \$24.500.000 in tools (in this case is database) \$600.000 in testing equipment intended for software that supports the innovation process, and in “Space” 1.666.666 are invested in laboratory maintenance.

In addition, based on the selected company, the Capacities Diagnosis of Technological Innovation showed that in the period it was analyzed (one semester), the company reported an investment of \$32' 322.880 in Personnel, Technologies and Space. The selected company directed 47'551.931 (monetary units) of its resources to each Technological Innovation Capacity, as shown on the following indicator.

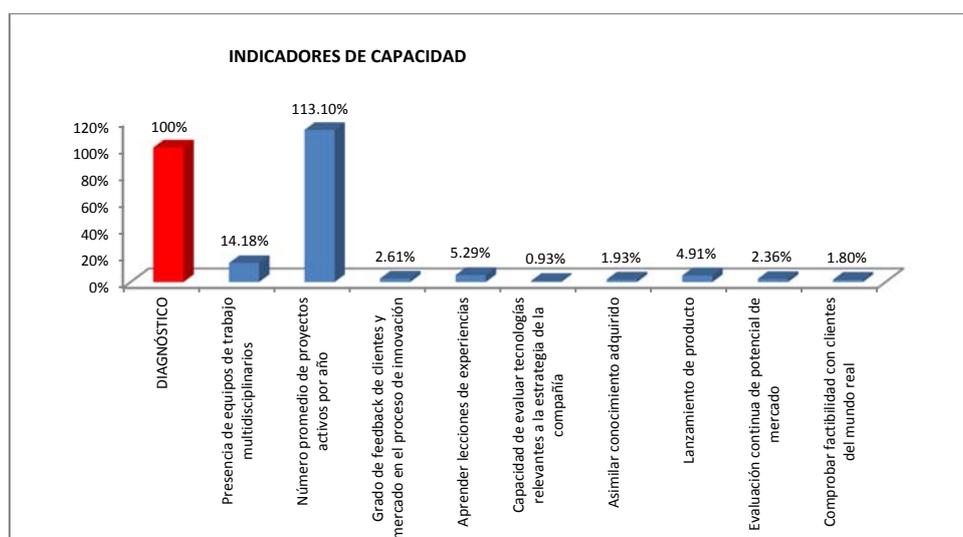


Figure 10: Indicator results of the company

From the evidence provided above, there is an overuse of resources within the company, just the “active number of projects per semester” indicator consumes up 113.10% of all technologic, space and personnel resources. This indicates that it is the key factor for the development of activities of technological innovation; however, it does not have the needed resources to execute it the adequate way. In addition, other characteristics of technological innovation capacities possibly do not have enough resources to complete them, therefore, hindering the execution of a comprehensive plan for technological innovation. The information confirms a bad distribution and lack of resources of the organization involved, it surpasses a 47% of resources intended for the development of activities of technological innovation. As a result, the company is suggested to increase the resources intended for the mentioned activities or to restructure them in order to reduce work overload of employees and facilities, achieving the adequate use of resources.

## **CONCLUSIONS**

After analysing the environment of the agribusiness nationwide, Colombia does not have a well-defined sector due to the wide range of differences among the subsectors that conform the Colombian agribusiness. Consequently, there are vast differences in the capacities of technological innovation between one subsector and the other when it comes to technological development, which is evident in the increased participation of international markets in a high technological development and in a greater economic capacity to invest in activities of research and development.

We were able to identify the capacities of the Colombian agribusiness sector, having as a result, R&D, marketing and knowledge capacities. A group of indicators were created to facilitate the measurement of each capacity, giving as a result an evaluation of monetary resources (People, Technology, Space) intended for the R&D process and its percentage of use, this will allow the company to have a history of behavioral aspects of the business, make better decisions, and create alerts on the most deficient processes of the organization.

By implementing this tool in a company as a case study and by analysing the characteristics present in diverse technological innovations capacities, a misuse and bad allocation of resources due to overuse of people, technologies, and spaces participating in the development of the innovative activities were evident, thus affecting significantly the human resource. This explains the vast number of projects managed by the company and the lack personnel available for its execution.

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