

# MENDIVE

## REVISTA DE EDUCACIÓN

Translated from the original in Spanish

### Training program for producers for the introduction of agricultural technologies

#### Programa de capacitación a productores para la introducción de tecnologías agropecuarias

#### Programa de capacitação de produtores para a introdução de tecnologias agrícolas

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#### ABSTRACT

It is a political will of the Cuban government to draw strategic lines in the sustainable food production program through alliances between local governments, universities and productive entities. That is why this article aimed to socialize a training program for producers that encourage the introduction of technologies in the agricultural sector. The dialectical-materialist method predominated as a general method. Theoretical level methods such as: the historical-logical, the induction deduction and the analysis and synthesis were used. From the empirical level, document review, surveys, performance observation, and expert consultation were used. The methodological triangulation technique was used and the percentage calculation was used for information processing. This result has been introduced since 2020 in farms of the Camilo Cienfuegos Genetic Livestock Company and the Punta de Palma Livestock Company, showing partial favorable results in the satisfaction levels of the producers and the efficiency of the companies. Didactic materials of the technological procedures for the producers were elaborated, the actions of preparation of the participatory workshops were determined from the collaborative learning and it was contributed to improve the professional competences of the producers for the efficient fulfillment of their work functions.

**Keywords:** collaborative learning; training; university-company integration; introduction of technologies; program; agricultural producers.

#### RESUMEN

Es una voluntad política del gobierno cubano trazar líneas estratégicas en el programa de producción sostenible de alimentos mediante alianzas entre los gobiernos locales, las universidades y las entidades productivas. Es por ello que este artículo tuvo como objetivo

socializar un programa de capacitación hacia los productores que dinamice la introducción de tecnologías en el sector agropecuario. Predominó como método general el dialéctico-materialista. Se emplearon métodos del nivel teórico como: el histórico-lógico, la inducción-deducción y el análisis-síntesis. Del nivel empírico se empleó la revisión de documentos, la encuesta, la observación del desempeño y la consulta de expertos. Se empleó la técnica de triangulación metodológica y para el procesamiento de la información se empleó el cálculo porcentual. Este resultado se introduce desde el 2020 en fincas de la Empresa Pecuaria Genética "Camilo Cienfuegos" y la Empresa Pecuaria "Punta de Palma", mostrando resultados parciales favorables en los niveles de satisfacción de los productores y la eficiencia de las empresas. Se elaboraron materiales didácticos de los procedimientos tecnológicos para los productores, se determinaron las acciones de preparación de los talleres participativos a partir del aprendizaje colaborativo y se contribuyó a mejorar las competencias profesionales de los productores para el cumplimiento eficiente de sus funciones laborales.

**Palabras clave:** aprendizaje colaborativo; capacitación; integración universidad-empresa; introducción de tecnologías; programa; productores agropecuarios.

## RESUMO

É vontade política do governo cubano traçar linhas estratégicas no programa de produção de alimentos sustentáveis por meio de alianças entre governos locais, universidades e entidades produtivas. Por isso, este artigo teve como objetivo socializar um programa de capacitação de produtores que incentive a introdução de tecnologias no setor agropecuário. O método dialéctico-materialista predominou como método geral. Utilizaram-se métodos de nível teórico como: o histórico-lógico, a indução-dedução e a análise-síntese. A partir do nível empírico,

utilizou-se a revisão documental, levantamento, observação de desempenho e consulta a especialistas. Foi utilizada a técnica de triangulação metodológica e o cálculo da porcentagem foi utilizado para o processamento das informações. Este resultado vem sendo apresentado desde 2020 nas fazendas da Genética Pecuária "Camilo Cienfuegos" e da Pecuária "Punta de Palma", apresentando resultados parcialmente favoráveis nos níveis de satisfação dos produtores e na eficiência das empresas. Foram elaborados materiais didáticos dos procedimentos tecnológicos para os produtores, as ações de preparação das oficinas participativas foram determinadas a partir da aprendizagem colaborativa e contribuiu para melhorar as competências profissionais dos produtores para o cumprimento eficiente de suas funções de trabalho.

**Palavras-chave:** aprendizagem colaborativa; Treinamento; integração universidade-empresa; introdução de tecnologias; Programa; produtores agrícolas.

## INTRODUCTION

In Cuba, it constitutes a political will of the State to design strategic lines for the sustainable production of food, through alliances between local governments, universities and the agricultural productive sectors. It is about implementing new conditions for local planning based on the potential of endogenous resources. The implementation of territorial innovation and development projects in the business sector that significantly affect the socioeconomic variables of each territory constitutes a challenge and, at the same time, an opportunity to specify the development objectives for the 2030 Agenda.

The introduction of technologies in the agricultural sector is a complex process that can cover a considerable period of time, since it requires that the actors involved have the resources and tools to make them reach the end users (Cadena, Guevara, Argüello and Rendón, 2018). It is about managing sufficient and relevant technologies to generate, transmit and consolidate productive yields, so it is necessary that engineers, technicians, workers and everyone who participates in the management are duly updated.

Consequently, a scientific-technological policy is promoted with the harmonious participation of academic institutions and that, together with local governments, promote a great articulation between the productive network and the educational system. It proposes an integrated vision of the various actors that participate in the innovative process at the local level; from those who produce knowledge and transmit it to those who use it and apply it for the benefit of society, allowing to identify the potential of the territory through diagnosis as an important tool in the planning of innovation and development projects.

It is up to the university to direct all its efforts towards the preparation of human resources capable of generating correct and timely solutions to the diversity of agricultural business economic activity, to obtain results that enhance the strengthening of the local knowledge management system based on to facilitate the introduction and exchange of technologies at the local level and to develop training and promotion of technological alternatives that increase efficiency (Báez, Hernández, Perdomo, Garcés and Alibet, 2018).

Training as an educational process is viewed as a strategic tool, without which any change in the organization would be difficult to carry out with a deep vision of business management and with the necessary professional competencies (knowledge,

aptitudes, abilities, skills, capacities and values), in order to manage and face complex problems from work in interdisciplinary teams (Labrador, Bustio, Reyes and Cionza, 2019).

Thus, the adoption of sustainable technologies requires the training of human capital, with the perspective and knowledge necessary to ensure the sustainability of agricultural production systems adjusted to their productive needs, identifying from the theory some deficiencies given by:

- The objectivity, relevance and systematicity of the training process for innovation and the introduction of agricultural technologies.
- The management of knowledge and the transfer of impact technologies from the University-Company integration.
- The level of professional technical competitiveness of agricultural producers on scientific-methodological bases.

In search of more information, an exploratory study was carried out on the training process for the introduction of agricultural technologies, where methods such as: surveys, observation of the performance of producers in activities and the review of science and technique plans of the participating entities were applied. The inquiries carried out are preceded by the theoretical result in the *Technological Management Model: university-Cuban livestock company relationship* by Benítez, Díaz, Fernández, Martínez and Alonso (2017).

The limitations are given, fundamentally, in the combination of training forms for the introduction, monitoring and technological surveillance, in correspondence with the diagnosis of the different productive forms and the development and innovation needs, lack of systematicity in training actions in

correspondence with the phases of technology transfer; the use of educational contexts is limited for the production of new knowledge and the self-preparation of local actors is seldom based on scientific-methodological bases.

The scientific solution of these insufficiencies entails raising new demands for the training process, which leads to the need for this research and, consequently, the following scientific problem is formulated: how to conceive, towards producers, the training process that stimulates the introduction of technologies in the agricultural sector?

In this sense, the objective of the research is: to socialize a training program for producers that encourages the introduction of technologies in the agricultural sector.

## MATERIALS AND METHODS

The research was developed from the year 2020 on farms of the Genetic Livestock Company "Camilo Cienfuegos" and the Livestock Company "Punta de Palma" and 28 agricultural producers participated. The dialectical-materialist method predominated as a general method, which made it possible to operate with its laws, categories and principles.

Methods of the theoretical level were used: the historical-logical analysis made it possible to determine the evolution of agricultural training and the references for the introduction of technologies in the business sector; The induction-deduction allowed to go from the particular to the general of the direction of the educational process and the identification of the features, assumptions and demands, as well as to arrive at the elaboration of the training program.

The analysis and synthesis, in interrelation with the other methods, was used in the processing of all the information, in the study of bibliographic sources to determine the scientific problem and in the establishment of the regularities to design the program, integrating the organizational components.

From the empirical level, the Science and Technology plans of the companies were reviewed. Surveys were applied through questionnaires to diagnose in the producers the satisfaction indexes with the training process and the participatory workshops carried out through social networks. Performance observation allowed corroborating in practice the appropriation of the learning object and its application in the productive context. The methodological triangulation technique was used.

For the theoretical evaluation of the program, the consultation of experts in its Delphi variant was used, with a view to its final elaboration and implementation in educational practice.

For the information processing, the percentage calculation was used in the analysis of each indicator measured by the instruments.

A validation workshop of the program was developed for professional reflection, analysis of results and decision-making.

## RESULTS

In the review of the training plans of the entities, it was possible to corroborate that there were limitations in the organized planning of activities for management, innovation and technology transfer from the University-Company context, which directly involves producers, since 62% of them were aimed essentially at managers and specialists.

When studying the satisfaction indexes of the producers through surveys, it was confirmed that they received updating and scientific-technical preparation (95%); however, they did not always appropriate the tools, procedures and methods to apply the acquired knowledge, taking into account the local resources available to them. The observation of the performance of the producers in the training activities showed inadequacies in the combination of forms of training in correspondence with the needs of the producers and the demands of Cuban agriculture, lack of systematicity in the participatory conception that generates cooperation and assistance between the producers for the appropriation of the content and limited action for the production of new knowledge on scientific-pedagogical bases.

The analysis carried out revealed the need to conceive a training program for the introduction of agricultural technologies, characterized by being relatively constant, systematic and structured in stages, which are described below:

### **Stages of the training process for the introduction of technologies in the agricultural sector:**

#### 1. Diagnosis of training needs.

In this stage, we started from the objective reality and the requirements of the producers, identified through the application of surveys with diagnostic guides and productive indicators on the farms.

The identification of training needs had advantages that facilitated the organization of activities according to the priorities and available resources and allowed the diagnosis of the current situation that was the driving force for evaluating the impact of the training. In addition, didactic materials of the technological procedures to be introduced

were elaborated, as well as the guidelines for the technological discipline.

2. Establishment of strategic alliances from the University-Company integration as a dynamic axis for management and technological innovation, identifying human and material resources.

The program belongs to the project "Integration in the management of technology and innovation, a necessity for the agricultural sector in the province of Pinar del Río", which runs the University of Pinar del Río "Hermanos Saiz Montes de Oca", as a whole with the Soil Institute, the Information and Technological Management Center, the "Camilo Cienfuegos" Livestock Genetic Company and the "Punta de Palma" Livestock Company and, consequently, the respective economic contracts were signed for the legality of the agreed activities.

The companies assumed the expenses associated with the training for the introduction of the technologies, delivering in a timely manner the resources for the development of the program, as well as they designated the people who were an active part of the team, one of whom was responsible for ensuring strictly by compliance with the methods and procedures of each technology introduced. A multidisciplinary team was created to develop the training program.

3. Planning, organization, execution, control and evaluation of the training program.

The training program is an instrument that encompasses the conception of a system of activities, strategies, procedures, time, and human and financial resources involved in the training process.

It was characterized by assuming Popular Education and the peasant culture of the communities, collaborative learning mediated by Information and Communication

Technologies (ICT) and teamwork, from a participatory conception among those involved that generated cooperation, help and accompaniment of the University specialists in the companies and their respective farms.

The evaluation was conceived as a process and result of the training program evidenced in the competitiveness of those trained and business efficiency.

It included the relevance of the training activities declared by those trained, the learning evaluation, the ability to transfer the appropriate content to the production process and, finally, the impact evaluation that is evidenced in the economic results obtained by the resulting companies. of the introduction of technologies.

4. Instrumentation of the different reports of technological surveillance sponsored by the Institute of Scientific and Technological Information, in correspondence with the technologies introduced.

It included the follow-up and control during the introduction of each technology, the systematic monitoring and the application of investigative methods.

Taking into account the stages, the structure of the program was proposed, resulting as it is expressing in the resumption.

### **Structure of the training program for the introduction of technologies in the agricultural sector**

#### 1,-Establishment

The Marxist-Leninist Philosophy was assumed (objectivity, historical-concrete analysis and universal concatenation of objects, facts, phenomena and processes); these demands are approached from a dialectical-humanist perspective, considering the relationships that are

established between man, society and nature.

From the Theory of Knowledge, the dialectical interrelation of the subject and the work objects and of the subjects with each other was assumed, the role that practice plays as an evaluative criterion of truth, as well as the relationship between management and technology transfer and their interaction with the productive environment, which becomes a challenge, enabling the integration of scientific-technical knowledge in practice, for which the solution of pertinent problems of collective interest, of individual interest and, above all, of Social interest was prioritized.

From the sociology of education, it is significant that the development of the producer was considered under the influence of education and context. Training tends to interpret social needs in a way that enhances exchange and stimulates the response capacity between institutions.

From pedagogical psychology, the historical-cultural approach of Vigotsky (1987) was assumed, which provides an explanation about the possibilities of the educability of the producer and the appropriation of knowledge for the introduction and technological discipline, which lead him to improve and modify production processes.

The pedagogical foundations are focused on popular education also known as liberating education. This is considered a philosophical approach, which understands education as a participatory and transformative process, in which learning and conceptualization are based on the experiential experience of the participating individuals and the group through popular awareness in the construction of knowledge.

The Teaching-Learning Process was characterized by the intentional and conscious organization of organizational

forms, mainly participatory workshops as spaces for promotion, development, application and socialization, manifesting the dialectical unity between activity and communication. Consequently, from the Didactics of Higher Education, the relationships between the categories and the protagonists of the process were considered, associated with the productive contribution, food security and sovereignty, increased efficiency and competitiveness.

The program was based on a system of principles such as:

- Principle of linking theory with practice: it has practical teaching as the center for acquiring and applying scientific and technological knowledge, solidly linked to collaborative learning.
- Principle of University-Company integration: the integration process, as the central axis of competent professional training, which allows the understanding of the educational and technical phenomena that occur in the introduction of technologies.
- Principle of the relationship of the scientific nature of the content, research, cognitive independence and extensionism, which conditions the internal characteristics of the designs, the methods, forms and ways to be used; and, consequently, the scientific-pedagogical requirements of the training program.

### **General objective**

Train producers with a strategic vision of the Teaching-Learning Process, for the introduction, monitoring and control of agricultural technologies.

### **Specific objectives**

- Diagnose the training needs of producers and companies through

diagnostic guides and indicators on the farms.

- Develop professional skills through collaborative learning and ICT, in correspondence with the capacities and dynamics of the agricultural sector.
- Evaluate the training program for the introduction of technologies (management of innovation, knowledge and R + D + i activities from the University-Company integration), generating frameworks for intra and inter-institutional cooperation.

2. Didactic components and their interrelation in collaborative learning mediated by ICT

The Didactics of Higher Education studies the Teaching-Learning Process as a particular type of social activity, manifesting the dialectic between activity and communication, which is why it is necessary to treat productive professional situations from transformation technologies of agricultural production and the emergence of new problems; This forces a permanent search to redesign the objectives, contents and ways of conceiving the training process.

The planning of the objectives by the teacher-facilitator was in line with the expected transformations in the producers, providing sufficient information on the content of each technology and the transfer of knowledge to solve specific problems of production and services.

Problem methods were selected that promoted self-management of learning and the transformation of the productive environment with interactivity, where dialogue and information exchange were promoted using simple procedures for the search for scientific-technical knowledge, peasant traditions in food production; as well as the critical and participatory sense.

The incorporation of ICT as teaching aids constitutes a training need in the current context of COVID-19. Communication tools were used: video and image publication, concept maps, shared documents, social networks, instant messaging (WhatsApp), videoconferencing, Moodle as a platform for bibliography, procedural manuals and technology surveillance, among others. Technological diffusion made it possible to reorient the direct training scheme from some producers to others where extension agents are trained on technologies and protocols, achieving greater coverage and impact.

The forms of organization were essentially participatory workshops associated with resources such as: procedure manuals, technical instructional brochures, training guides, among others.

The participatory workshop favored the development of competencies for the comprehensive solution of professional problems, stimulated interpersonal relationships, the production of ideas, assuming positions, cooperative work, reflection and debate as part of creativity so that practice and theory are complement. Each form included: name of the activity, duration, participants, place, time, teacher, bibliography, objectives, contents, method and procedures, teaching aids and evaluation.

At present, the work environment demands more and more team dynamics, work groups and more horizontal structures, where collaborative learning as a teaching model in the introduction of agricultural technologies constitutes an important reference due to the multicultural nature.

The collaborative work allowed to carry out a reflection on the existing resources and their use in different contexts, requiring the assistance of a group of individuals who work together and collaborate in the achievement

of an objective that, individually, would be very complex to fulfill. It is characterized by:

- Individual and group responsibility: each member is responsible for their individual and collective performance for the execution of the task. It implies distributing certain content in an equitable and balanced way to achieve learning in a bilateral and autonomous way.
- Interdependence: consists of the individual contribution that depends on the tasks carried out by other members of the team.
- Communication skills: they are necessary in the roles of each member, for the analysis and debate of ideas, the production of knowledge and the timely taking of solutions with the participation of all.
- Interactivity: favors interpersonal relationships through learning strategies that allow learning together, having ICT as mediating resources. These collaborative spaces seek to create participatory work environments and provide the possibility of building common knowledge among the participants using the new communication channels available.

This conception of learning allowed agricultural producers to exchange their experiences and culture, reflecting on their own perspectives and those of others to expand points of view through extensionism.

### 3. Modules by technologies

The introduction of technologies is a process by which knowledge is transmitted, assimilated and adapted in various ways, from one organizational framework to another. Said process implies taking into consideration aspects such as: the characteristics of the technology, the type of agents that transmit it and those who receive



it, the cultural context in which said transfer takes place and the possible impact on the company.

The modules proposed in the program laid their foundations in the domain of technological processes and production challenges, attending to:

- The diversification of alternative agricultural production systems, through the introduction of sustainable technologies and permanent technological surveillance that favors the increase in productivity.
- The promotion of agroecological practices that guarantee a rational use of land exploitation, developing spaces for the promotion, development, application and dissemination of technologies, which together with the training of personnel allow the generalization of results.
- Development of extensionism to raise individual and collective awareness, trying to stabilize and increase efficiency indicators.

The technologies to be introduced are:

- *Cenchrus purpureus* cv. Biomass banks Cuba CT-115.
- Elaboration of multinutritional blocks for bovine supplementation.
- Sowing of *Cratylia argentea* cv. summery as a seed bank.
- Silvopastoral systems using *Tithonia diversifolia* for grazing areas in dairy farms.

Within the knowledge system of each module there was: conceptualization of technology; advantage; basic components; procedure for establishment; indications for handling; surveillance and technological discipline.

4. Control and evaluation of the process and its results

Satisfaction instruments were applied, in addition to observation of the performance of each producer in the Teaching-Learning Process. It was effective to consider the benefits of training in terms of innovation and knowledge management in the company. The evaluation of the training program considered the following indicators:

- Degree of satisfaction: it means the assessment, interest, attention and motivation of those involved.
- Performance level: included the levels of appropriation of the content through collaborative learning.
- Degree of transfer to the production process: refers to the applicability of the appropriate content of each technology to the production process.
- Impact evaluation: allowed to determine the changes operated through the training actions that are evidenced in the economic results obtained from the application of the technologies.

For the evaluation of the training program, the method by expert consultation was used to corroborate its functionality in educational practice on a theoretical level and to make the pertinent corrections.

For the determination of the experts, the following requirements were taken into account:

- Scientific degree and academic title.
- Possess 15 or more years of professional experience in the Agricultural branch and / or research experience in the field of professional training.
- Be willing to collaborate with the results of the investigation.

After selecting the 18 possible experts, a self-evaluation questionnaire was applied requesting that they make evaluations about their competence, as well as the elements that made it possible to argue the criteria of the subject in question, obtaining as a result that the majority have as a coefficient of competence a level high, from the ranges established by the Delphy method.

The operation was carried out following the code of interpretation of such competition coefficients:

If  $0.8 < k < 1.0$  competition coefficient is high.

If  $0.5 < k < 0.8$  coefficient of competence is medium.

If  $k < 0.5$  coefficient of competence is low.

The results obtained allowed to arrive at the following considerations:

There are 13 (86.6%) experts who evaluated the correspondence of the foundation that supports the program from Popular Education, collaborative learning mediated by ICT and Very Adequate teamwork; however, 2 (13.4%) of the experts consider it Fairly Adequate.

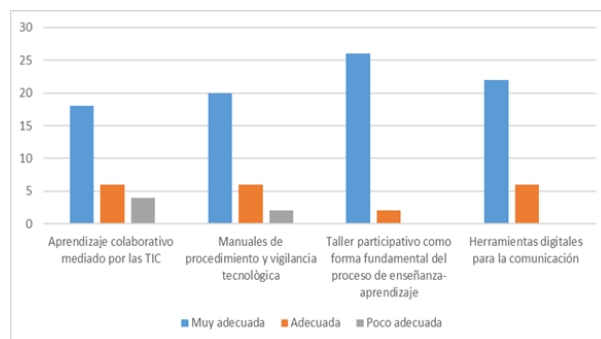
When referring to the stages and structure of the training program, in correspondence with the phases for the introduction and transfer of technologies in the agricultural sector, 13 (86.6%) experts evaluate it as Very Adequate, 1 (6.7%) evaluate it Fairly Adequate and 1 (6.7%) considered it Adequate.

The incorporation of ICT into the Teaching-Learning Process in the current context of COVID-19 is relevant due to the active role of producers in their training and personal growth process, reflecting on their own perspectives and those of the leading producers to expand their own views through

extensionism; According to the criteria of all the experts (100%) it is Very Adequate.

The introduction of technologies (management of innovation and R + D + i activities from the University-Company integration), generating cooperation frameworks due to its systemic, interdisciplinary, integrative, transformative and practical nature is considered Very Adequate by 12 (80 %) experts, 2 (13.4%) evaluated it as Fairly Adequate and 1 (6.6%) as Adequate.

The methodological triangulation showed that agricultural producers show high degrees of satisfaction with the training process received.



**Graph 1-** Results of the methodological triangulation

The level of satisfaction of the producers with the procedural manuals and technological surveillance as teaching aids is significant, as well as the socialization and feedback through communication tools, being the publication and image of folding pages on the GETECA page (38%), WhatsApp messaging (30%) and participation in online events (Food Production with more Science) with 20% contributing the most to the process.

## DISCUSSION

Sustainable economic development lies in the potential of companies to innovate and manage impact technologies with productive efficiency. In this regard, the training was conceived as a strategic instrument in business management to face the adoption of sustainable technologies adjusted to the technological diagnosis and the needs of the producers, in accordance with Honores, Vargas, Espinoza and Tapia (2020), which the study requires of the technical deficiencies of the clients of the productive sector and the preparation of the human resources; Therefore, the higher the work performance, the better the results obtained by the companies and their objectives will be materialized in efficiency and performance.

A system-like process is conceived that involves multiple actors and entities, generating the production of knowledge from science and its application in the production process, expanding the competencies, capacities, opportunities, motivations and interests, harmonizing with the results obtained by Cionza, Davis and Labrador (2019), who propose that organizations become an entity, in continuous learning, where their members feel involved and motivated by the training process.

In the structuring of the program, the following are specified: the stages, the foundations, principles and the interrelation of the didactic components, assuming Popular Education as theoretical bases and emphasizing extensionism, collaborative learning and the use of ICT in participatory workshops. This allowed to stimulate the introduction of technologies in the agricultural sector, since it included pedagogical practices that consider education a path for cultural transformation, coinciding with Romero, Ortiz and La O (2018) who point out that knowledge is built in a process of active exchange between the knowledge of science, popular experience

and daily life, which defends group work and which assumes the knowledge process from the transformed practice-theory-practice relationship.

Collaborative learning mediated by ICTs used techniques that activated reflection and debate as part of the creativity of those involved, allowed producers to project their concerns and thoughts with more autonomy, promoting the development of metacognitive skills and commitments in the educational context to obtaining collective achievements.

That is why an essential characteristic of the training process that was studied is its participatory condition, since from the beginning popular experiences and knowledge were retaken and reflective processes were developed generating analysis and dialogue in a healthy environment, of trust and openness to that all those trained feel in a comfort zone to express their ideas and results, agreeing with the results obtained by Rodríguez and Vega (2019), Lizcano, Barbosa and Villamizar (2019) and Pachay, Rodríguez and Vera (2020).

In conclusion, the training program responded to the technological needs of clients in the productive sector, allowing them to develop skills to transfer their knowledge to the productive process as a good practice extension agent.

This program also allowed the visualization of the company as a training entity for its human resources, in a climate of reciprocal cooperation for the training of key actors in technological innovation processes.

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y Educación.

**Conflict of interest:**

Authors declare not to have any conflicts of interest.

**Authors' Contribution:**

The authors have participated in the writing of the work and analysis of the documents.



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