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Original article

Agricultural extension strategy for the introduction of bioproducts in agricultural enterprises

Estrategia de extensión agraria para la introducción de bioproductos en entidades agropecuarias

Estratégia de extensão rural para a introdução de bioprodutos em entidades agropecuárias

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ABSTRACT

In recent years, the Cuban agricultural sector has implemented measures to revitalize agriculture, in which universities have played a pivotal role. The objective of this research was to design an agricultural extension strategy for the Pinar del Río Agricultural Supplies Company that addresses the introduction of bioproducts and other agricultural inputs into agricultural entities in the region. The historical-logical and analysis-synthesis methods were employed. Through a participatory

assessment, the strengths, weaknesses, threats, and opportunities of the agricultural extension process were identified. The research was structured in four stages: assessment, analysis of the assessment, strategy development, and validation using the Delphi method of expert consultation. The matrix weighting showed that the process falls within the reorientation quadrant, indicating a situation characterized by weaknesses and opportunities. The overall assessment of the strategy confirmed its validity and feasibility. The proposed actions constitute a possible response to the internal and external constraints the company faces in introducing bioproducts and other agricultural inputs to entities in the sector.

Keywords: bioproducts; rural development; agricultural extension; business management; agricultural innovation.

RESUMEN

En los últimos años, el sector agropecuario cubano ha implementado medidas para la reactivación de la agricultura, donde el papel de las universidades ha sido transcendental. La presente investigación tuvo como objetivo diseñar una estrategia de extensión agraria para la Empresa de Suministros Agropecuarios de Pinar del Río que responda a la introducción de bioproductos y otros insumos agrícolas en entidades agropecuarias del territorio. Se emplearon los métodos histórico-lógico y análisis-síntesis. Mediante un diagnóstico participativo se identificaron fortalezas, debilidades, amenazas y oportunidades del proceso de extensión agraria. La investigación se estructuró en cuatro etapas: diagnóstico, análisis del diagnóstico, estructuración de la estrategia y validación mediante el método Delphi de consulta a expertos. La ponderación de la matriz mostró que el proceso se encuentra en el cuadrante de reorientación, indicando condiciones de debilidades-oportunidades. La valoración general de la estrategia corroboró su validez y factibilidad. Las acciones propuestas constituyen una posible respuesta a las limitaciones internas y externas que enfrenta la empresa para la introducción de bioproductos y otros insumos agrícolas en entidades del sector.

Palabras clave: bioproductos; desarrollo rural; extensión agraria; gestión empresarial; innovación agrícola.

RESUMO

Nos últimos anos, o setor agropecuário cubano implementou medidas para a reativação da agricultura, processo no qual o papel das universidades tem sido fundamental. A presente pesquisa teve como objetivo elaborar uma estratégia de extensão rural para a Empresa de Suprimentos Agropecuários de Pinar del Río, visando atender à introdução de bioprodutos e outros insumos agrícolas em entidades agropecuárias da região. Foram utilizados os métodos histórico-lógico e de análise-síntese. Por meio de um diagnóstico participativo, identificaram-se pontos fortes, pontos fracos, ameaças e oportunidades do processo de extensão rural. A pesquisa estruturou-se em quatro etapas: diagnóstico, análise do diagnóstico, estruturação da estratégia e validação mediante o método Delphi de consulta a especialistas. A ponderação da matriz indicou que o processo se encontra no quadrante de reorientação, refletindo uma situação caracterizada por pontos fracos e oportunidades. A avaliação geral da estratégia confirmou sua validade e viabilidade. As ações propostas constituem uma possível resposta às limitações internas e externas enfrentadas pela empresa para a introdução de bioprodutos e outros insumos agrícolas em entidades do setor.

Palavras-chave: bioprodutos; desenvolvimento rural; extensão rural; gestão empresarial; inovação agrícola.

INTRODUCTION

In recent years, the Cuban agricultural sector has implemented a set of measures aimed at revitalizing agriculture in order to meet the population's nutritional needs. There is a need to outline lines of work that contribute to the country's socioeconomic management (Pérez Anzardo et al., 2023), as well as to develop tools that support this objective. Promoting local development for food production has become a strategic dimension of national security.

In this context, universities play a pivotal role. As academic and research centers linked to scientific, technical, and social progress, they are called upon to contribute to updating educational content and to offer professional development programs that generate new knowledge and ensure sustainable, development. Training, conceived from an extension perspective, is the key to rural improvement (Khan et al., 2025). It represents a business investment, from which a return is

expected in the form of improved work performance, optimizing the use of available financial and material resources (Rodríguez Hernández & Vega Cruz, 2019).

However, there remains a limited understanding of extension processes that facilitate the adoption of more sustainable and environmentally friendly technologies. In this regard, implementing training and extension strategies that promote and drive innovation (de la Cruz Santos & Infante Abreu, 2022) is emerging as one of the most effective ways to transform human capital and as a primary means of increasing yields in agricultural enterprises. It is therefore considered an investment whose results are evident in the short, medium, and long term (León Ramentol et al., 2021).

The adoption of technologies necessarily requires the preparation of human capital, equipping it with the perspective and knowledge that ensure the sustainability of production systems, tailored to their actual needs. Agricultural extension serves as an important intermediary solution to the challenges bridging the gap between scientific innovation and the agricultural community (Badavath et al., 2025). However, empirical evidence from an exploratory study of the Pinar del Río Agricultural Supplies Company reveals certain limitations. These limitations are reflected in the combination of extension approaches used to introduce bioproducts and agricultural inputs into the productive sector, the lack of a systematic approach to ensuring the adoption of the content, and the producers' lack of self-preparation based on scientific and methodological foundations in the training processes.

The scientific resolution of these shortcomings imposes new demands on the extension process, which justifies this research. Therefore, the objective of this study is to design an agricultural extension strategy for the Pinar del Río Agricultural Supplies Company that addresses the introduction of bioproducts and other agricultural inputs into entities within the territory, thereby contributing to the necessary transformation of the sector.

MATERIALS AND METHODS

The research was conducted using a mixed-methods approach, with a qualitative focus supported by quantitative techniques; it was non-experimental in nature and had a cross-sectional-descriptive scope. The study was carried out between January 2022 and December 2024 in the province of Pinar del Río, Cuba, using the enterprise and its agricultural extension system as the unit of analysis.

The study population consisted of specialists, facilitators, promoters, and producers involved in the extension process across the province's eleven municipalities. The sample, selected through non-

probabilistic purposive sampling, comprised 18 key informants: 6 company specialists, 6 municipal facilitators, and 6 leading producers from the cooperatives, which provided a multisectoral perspective on the process. The methodological design was structured into four sequential phases, described below.

Phase 1: Assessment of the extension process

To characterize the current state of the process, qualitative and quantitative techniques were combined. Eighteen semi-structured interviews were conducted with the key informants to explore the following: work experience, technical and interpersonal skills, adaptability and motivation, problem-solving ability, professionalism, and flexibility. In addition, 11 participatory workshops -one in each municipality- were held with the work teams of the Grassroots Business Units, during which collective debate and group reflection were encouraged. To supplement this information, direct observation visits were conducted at the production units, and the company's guiding documents on science and technology plans were reviewed. The information collected was organized using content matrices and triangulated to ensure the internal validity of the findings.

Phase 2: Analysis of the Strengths, Weaknesses, Opportunities, and Threats (SWOT) Matrix

Based on the results of the assessment, a SWOT matrix was constructed. To this end, an internal assessment (weaknesses and strengths) and an external assessment (threats and opportunities) of the extension process were conducted. The identified factors underwent a process of reduction and prioritization through group dynamics with the company's specialists, reaching a consensus on the most influential elements. Subsequently, a relational weighting procedure was applied, which consisted of evaluating the interactions among the four quadrants: Strengths-Threats, Strengths-Opportunities, Weaknesses-Threats, and Weaknesses-Opportunities. For each relationship, a value of 3, 2, or 1 was assigned if the answer to the control question was positive (e.g., "Does this allow for mitigation?" or "Does this allow for leveraging?") and 0 if it was negative. Horizontal, vertical, and total sums were calculated for each quadrant, which made it possible to determine the strategic positioning of the process and define the quadrant for priority action.

Phase 3: Planning, organization, and strategy design

Based on the results of the assessment and the SWOT analysis, the agricultural extension strategy was designed. The structural components of the proposal were defined: theoretical foundation,

strategic diagnosis, problem statement, general strategic objective, vision, mission, premises, and strategic planning. This was broken down into three specific objectives, each with its corresponding set of actions, people on charge, and timeline (2022-2024). For each action, evaluation indicators were established to measure producer satisfaction, performance achieved, and the economic impact of introducing the bioproducts. The design was carried out in a participatory manner, integrating the criteria of the company's specialists and local facilitators.

Phase 4: Validation of the strategy using the Delphi method

The proposal was submitted for expert review using the Delphi method. In this case, 10 experts with extensive experience in agricultural sciences, rural extension, and business management -drawn from both academia and the private sector- were preselected. To assess each candidate's competence, the competence coefficient (K) was calculated using the formula K = (Kc + Ka) / 2, where Kc represents the coefficient of knowledge on the subject and Ka the coefficient of argumentation based on the sources supporting their criteria. As a result of this evaluation, 8 of the 10 experts achieved a high level of competence.

During the consultation phase, a structured evaluation questionnaire was designed that included the strategy's key indicators (alignment of foundations, university-business relationship, relevance of Information and Communication Technologies (ICT), coherence of objectives, and feasibility of actions). This instrument was sent to the experts along with the complete theoretical proposal, and a feedback mechanism was established to collect qualitative observations. For data processing, matrices of absolute and cumulative frequencies were constructed, from which cumulative probabilities were calculated. Cut-off points were established to classify each indicator on a five-level ordinal scale: Very Adequate, Fairly Adequate, Adequate, Somewhat Inadequate, and Inadequate.

RESULTS AND DISCUSSION

The Pinar del Río Agricultural and Supplies Company is a Cuban state-owned entity under the Logistics Business Group of the Ministry of Agriculture, with a presence in all eleven municipalities of the province. Its primary corporate purpose is the wholesale and retail distribution of inputs, equipment, and technologies for the agricultural and forestry sectors, as well as the production of inputs and the provision of specialized services.

The company is undergoing a process of transformation and modernization, as evidenced by the creation of comprehensive logistics centers and its participation in innovation projects aimed at introducing bioproducts. Its collaboration with the University of Pinar del Río and other science and innovation entities positions it as a key player in rural development and food security in the region. Its mission is to facilitate the management of the extension process through the use of participatory techniques and methods, employing training as a necessary tool to achieve acceptance of bioproducts among producers.

The characterization, based on the results of the participatory assessment and the triangulation of information collected at production units, made it possible to identify the main strengths, weaknesses, opportunities, and threats involved in the entity's extension process.

Table 1. SWOT analysis matrix of the extension process at the Pinar del Río Agricultural Supplies Company

Strengths	Weaknesses
Existence of an organizational structure in each municipality of the province	Insufficient training of the specialists who carry out agricultural extension activities
Relationships with universities and institutions involved in research and teaching	Product demand is assessed without the participation of producers
Capacity and experience of managers, specialists, and researchers involved in managing the extension process	Lack of a training program on the use of bioproducts aimed at producers and decision-makers
Existence of good agricultural practices for managing the extension process	Differences between business language and the language of producers
Existence of an analysis of potential market demands for product commercialization	Lack of a communication strategy to raise awareness of the importance of bioproducts
Marketing is based on product demand, contracting, and sales	Inefficient use of participatory techniques and methods in the extension process |
Leading farmers identified for training and workshops	There is no defined structure with a presence at all levels that would allow extension work to reach the grassroots level

Opportunities	Threats
Political will that guarantees the implementation of the agricultural extension policy, as expressed in the economic and social policy guidelines of the Party and the Revolution	The organization, structure, and coordination of the agricultural extension system at different levels do not facilitate adequate support for the various forms of production
The country's new agricultural extension policy is currently in the process of being redesigned and approved	The effects of the blockade, which cause shortages of raw materials and agricultural inputs, affecting marketing and production
The implementation of the restructuring initiative, which promotes the adoption of research findings related to bioproducts, removes barriers to technology transfer, and contributes to the revitalization of the agricultural business sector	The Agricultural Extension System is not functioning properly
The low prices of most bioproducts, and the fact that they neither harm nor pollute the environment	
Existence of two projects (sectoral and territorial) for the promotion of bioproducts	

Source: Own elaboration based on the participatory assessment (2022-2024)

The results of the weighting analysis showed that the extension process must be reoriented. This finding indicates that, although there are significant internal and weaknesses, the external environment offers opportunities that can be leveraged to overcome these limitations. This assessment suggests the need to design an agricultural extension strategy for the introduction of bioproducts.

Structure of the strategy

Theoretical Framework: Extension refers to the pedagogical process involving the transfer of content with educational intent in rural areas. It provides advice and information to help farmers solve their problems through knowledge. This process has shifted from a top-down approach to technology transfer to a horizontal and participatory approach, as there is a growing need to increasingly value farmers as active agents in their own development (Rodríguez González et al., 2021). It is grounded

in the participatory approach to agricultural extension, collaborative learning, and the use of ICTs as tools to facilitate the training process.

Vision: A recognized entity in the management of the extension process, with a focus on collective and shared action among the stakeholders of the Agricultural Supplies Company, based on the needs of producers in the province of Pinar del Río.

Mission: To facilitate the management of the extension process through the use of participatory techniques and methods within the Agricultural Supplies Company in the province of Pinar del Río, using training as a necessary tool to achieve the adoption of bioproducts at the production level.

General strategic objective: To equip stakeholders with a strategic vision for managing bioproducts at the grassroots level through training and technical-advisory support that will accelerate the dissemination of results throughout the productive sector.

Strategic premises

1. Agricultural extension is conceived as a participatory educational process rather than a mere transfer of technology.
2. The University-Business coordination is fundamental to the generation and transfer of knowledge.
3. The active participation of producers is a necessary condition for the success of the extension process.
4. The use of ICT enhances collaborative learning and extension processes.

Strategic planning was translated into three specific objectives, each with actions, responsible parties, and a timeline (2022-2024).

Objective 1. Strengthen the extension system by identifying leaders in the production and marketing of bioproducts, as a result of partnerships with the sector's science, technology, and innovation communities and other research institutions.

Actions

- Define a structure (roles) with a presence at the provincial and municipal levels to strengthen extension efforts.

- Create a support team or promotional group to manage the extension process. People in charge: director general. 2022.
- Select leading producers in cooperatives to serve as promoters of extension activities on the use of bioproducts. People in charge: Marketing Specialists. 2022-2024.
- Strengthen ties with national and regional science, technology, and innovation institutions. People in charge: Development Directorate. 2022-2024.

Evaluation indicators: Number of identified and active leading producers, frequency of interactions with science and innovation entities, and producers' level of satisfaction with the support received.

Objective 2. Implement a training system for the agricultural extension process that ensures the presence of bioproducts in the commercial network and efficient marketing.

Actions

- Implement a professional development course: "Management of the extension process and its role in rural development." Course content: The importance of extension in rural development; communication in agricultural extension; group work and participatory assessment. 2 credits / 96 hours. Responsible: Human Capital Specialists. 2022-2023.
- Graduate-level training: Extension methods and techniques to facilitate work at the production level. Course content: Workshop design; role-playing; participatory techniques; collaborative learning. 1 credit / 48 hours. Organizer: University of Pinar del Río. 2023.

Evaluation indicators: Producers' performance level through collaborative learning; number of producers trained per municipality; degree of satisfaction with the courses offered; and practical application of knowledge in production units.

Objective 3. Design a communication system to disseminate the results of the development and implementation of bioproducts, leveraging their advantages and promoting their use as a tool for knowledge development and corporate benefit.

Actions

- Produce newsletters on monitoring, follow-up, and impact assessment activities. People in charge (Development Specialist). 2022-2024

- Select control fields or demonstration plots in each municipality where bioproducts are used (informal exchanges, field days, workshops, discussion sessions). People in charge: Development Specialist. 2022-2024.
- Develop informational brochures on technological procedures, audiovisual materials, and radio programs that highlight the impact of bioproduct use. People in charge: Communications Specialist. 2022-2024.

Evaluation indicators: Number of informational materials produced and distributed; coverage of demonstration plots by municipality; participation in field activities and workshops; and assessment of the economic impact of introducing bioproducts.

Validation of the strategy

The results of the validation using the Delphi method corroborate the validity and feasibility of the strategy at the theoretical level. The positive assessment of the University-Company relationship (62.5% rated as "Fairly Adequate") facilitates the adoption of technologies by establishing preparatory actions through participatory workshops based on collaborative learning. It is agreed with Becerra Encinales et al. (2024), who argue that improving the adoption of sustainable agricultural technologies centers on design and operational models that are more inclusive, adaptive, and attuned to the complex realities of farmers in emerging economies.

Studies in the province of Mayabeque show that the combined use of bioproducts is highly effective in increasing agricultural yields. However, their adoption in actual production conditions remains very limited. The authors conclude that adoption patterns depend on the general conditions of each farm and the knowledge of each producer, and that the success of innovation efforts requires support and guidance for producers (Miranda Mora et al., 2024). This finding reinforces the relevance of the proposed strategy, which emphasizes technical support and guidance as a central component.

The results of the assessment reveal internal weaknesses: insufficient preparation of specialists, the lack of specific training programs, and the absence of a communication strategy. These findings align with those of Gazmuri Roldán et al. (2024), who note that agricultural extension also serves as a link to producers and an interdisciplinary connection for action, but requires to drive local development, given that agricultural production is conceived from a multifunctional perspective.

The analysis places the process in the reorientation quadrant; although there are significant internal weaknesses, the external environment offers opportunities that can be leveraged to overcome these limitations. This strategic position is consistent with the findings of Díaz Arias et al. (2026) regarding the Agricultural Supplies Company in Artemisa, where critical weaknesses were identified, such as high dependence on imported inputs, limited infrastructure for the local production of bioproducts, and a shortage of specialized technical training. The fact that these limitations are present in both provinces suggests that these are not isolated problems, but rather structural challenges facing the sector that require systemic solutions.

The designed strategy incorporates theoretical and methodological elements that address the current challenges of agricultural extension in Cuba. The theoretical framework, based on a participatory approach and ICT-mediated collaborative learning, aligns with the views of Rodríguez González et al. (2021), who assert that extension has shifted from a top-down approach focused on technology transfer to a horizontal and participatory approach, in which farmers are valued as active agents of their own development.

In this context, extension workers exchange knowledge and experiences and jointly develop strategies to systematically address the challenges of agricultural practice (Landini, 2022). This paradigm shift is crucial, given that technology transfer to producers has predominated in Cuban extension work, with the limitation that it does not always meet the actual needs of producers.

The incorporation of ICTs as a mediating tool in the training process was rated as "Very Appropriate" by 75% of the experts. These results are consistent with those obtained by Solano et al. (2024), who considered that the virtual environment fosters both independent and collaborative work. This finding is also supported by the studies of Rodríguez Jiménez et al. (2023), who argue that ICT-mediated collaborative learning unfolds through a gradual process in which each participant feels committed to the learning of others, generating positive interdependence for the collective construction of knowledge.

Other authors found that approaches based on digital tools (Nouatin et al., 2025) promote higher levels of innovation adoption, primarily for non-technological innovations, while integrated approaches work better for technological innovations. Furthermore, both digital and integrated approaches are more effective for knowledge acquisition, and approaches based on digitization and those involving multiple stakeholders are more effective for fostering continuous innovation. These

findings validate the decision to incorporate ICT into the strategy as mediators of the collaborative learning process.

Structuring the strategy around three specific objectives reflects a comprehensive approach (Fernández Barrios et al., 2025) that simultaneously addresses the organizational, training, and communication dimensions of the extension process. This systemic approach is consistent with the views of de la Cruz Santos and Infante Abreu (2022), who argue that implementing training and extension strategies that promote and drive innovation is emerging as one of the most effective transformations in human capital and as a primary means of increasing yields in agricultural enterprises.

Regarding the study's limitations, it is acknowledged that the non-experimental design and the cross-sectional-descriptive scope prevent the establishment of causal relationships and the generalization of results to other contexts. Nevertheless, the triangulation of sources and techniques, as well as expert validation using the Delphi method, strengthen the credibility of the findings. Future research could address the implementation and evaluation of the strategy's impact in the medium and long term, as well as its adaptation to other regions and production contexts.

Finally, the proposed strategy constitutes a possible response to the main internal and external constraints the company faces in introducing bioproducts into the productive sector. The overall assessment of the strategy based on expert consultation confirmed its validity and feasibility, thereby contributing to the necessary transformation of the Cuban agricultural sector in the current context. It contributes to the adoption of bioproducts to replace imported inputs and the promotion of sustainable technologies as a strategic priority for national food security.

REFERENCES

Badavath, A., Praneeth, P., & Duggempudi, N. (2025). Role of Agricultural Extension in Facilitating Biotechnology Adoption: A Review. *Next Gen World Reviews*, *1*(2), 1-10. https://doi.org/10.66132/ss010201

Becerra Encinales, J. F., Bernal Hernández, P., Beltrán Giraldo, J. A., Cooman, A. P., Reyes, L. H., & Cruz, J. C. (2024). Agricultural Extension for Adopting Technological Practices in Developing Countries: A Scoping Review of Barriers and Dimensions. *Sustainability*, *16*(9), 3555. https://doi.org/10.3390/su16093555

de la Cruz Santos, I. D., & Infante Abreu, M. B. (2022). Estrategia para perfeccionar la gestión de ciencia, tecnología e innovación en el sector agrario cubano: Principales resultados. *Universidad y Sociedad*, *14*(3), 696-713. https://rus.ucf.edu.cu/index.php/rus/article/view/2916

Díaz Arias, E., Chile Bocourt, A., Morejón García, M., & Martínez García, A. (2026). Estrategia de innovación con bioproductos para la Empresa de Suministros Agropecuarios en Artemisa, Cuba. *Cooperativismo y Desarrollo*, *14*(1), e952. https://coodes.upr.edu.cu/index.php/coodes/article/view/952

Fernández Barrios, M., Barrios Barceló, Y., & Alvarez Iriban, M. (2025). Extensionismo de prácticas agroecológicas para mitigar los efectos del cambio climático. *Avances: Cuba*, *27*(2), 241-254. https://dialnet.unirioja.es/servlet/articulo?codigo=10117647

Gazmuri Roldán, J., Bullain Ceballos, L., Miranda Mora, I., & Camejo Serrano, Y. (2024). La internacionalización a partir de la extensión agraria: Un análisis teórico - conceptual. *Ingeniería Industrial*, *45*(1), 124-134. https://rii.cujae.edu.cu/index.php/revistaind/article/view/1259

Khan, R. P., Gupta, S., Daum, T., Birner, R., & Ringler, C. (2025). Levelling the field: A review of the ICT revolution and agricultural extension in the Global South. *Journal of International Development*, *37*(1), 1-21. https://doi.org/10.1002/jid.3949

Landini, F. (2022). Intercambio de experiencias y aprendizaje horizontal entre extensionistas: Fuente invisibilizada de conocimientos para la práctica. *Psicoperspectivas*, *21*(3). https://doi.org/10.5027/psicoperspectivas-Vol21-Issue3-fulltext-2643

León Ramentol, C. C., Menéndez Cabezas, A., Rodríguez Socarrás, I. P., García González, M. C., Quesada Leyva, L., & Quintana Verdecia, E. (2021). La capacitación como premisa para implementar un sistema de gestión de la calidad. *EduMeCentro*, *13*(2), 19-32. https://www.medigraphic.com/cgi-bin/new/resumen.cgi?IDARTICULO=106789

Miranda Mora, I., Fundora Sánchez, L. R., Martín Alonso, G. M., Trujillo Rodríguez, C. M., Gazmuri Roldán, J., & Rivera Espinosa, R. (2024). Adopción de la tecnología Ecomic® y Quitomax®

en cuatro fincas de Mayabeque. *Cultivos Tropicales*, *45*(4). https://ediciones.inca.edu.cu/index.php/ediciones/article/view/1832

Nouatin, F. G. K., Gouroubera, M. W., & Moumouni Moussa, I. (2025). Fostering farmers' innovativeness through training and extension approaches: A systematic literature review. *International Journal of Innovation Studies*, *9*(3), 284-300. https://doi.org/10.1016/j.ijis.2025.07.004

Pérez Anzardo, L. E., Infante Estrabao, F., & Hechavarría Laffita, U. (2023). Análisis del sector agropecuario como soporte del agroturismo para potenciar el desarrollo local. *RILCO: Revista de Investigación Latinoamericana en Competitividad Organizacional*, *5*(18), 18-32. https://dialnet.unirioja.es/servlet/articulo?codigo=9403000

Rodríguez González, N., Almaguer Pérez, N. A., & García Arias, J. M. (2021). Formación de posgrado en Extensión Agraria: Experiencias en Holguín, Cuba. *Revista Iberoamericana de Educación Superior*, *12*(33), 158-178. https://doi.org/10.22201/iisue.20072872e.2021.33.863

Rodríguez Hernández, E., & Vega Cruz, G. (2019). Estudio de la necesidad del uso de las TIC para la capacitación en el tema Gestión de Inventarios desde el puesto de trabajo. *Revista Referencia Pedagógica*, *7*(2), 168-190. https://rrp.cujae.edu.cu/index.php/rrp/article/view/184

Rodríguez Jiménez, S. L., Jardines González, S. B., Álvarez Marqués, J. L., García Montes de Oca, A., & Díaz Bofill, C. (2023). El aula invertida: Metodología didáctica para explicar la asignatura Agroecología y Agricultura Sostenible. *Revista Cubana de Educación Superior*, *42*(1), 87-100. https://revistas.uh.cu/rces/article/view/2404

Solano, J., Durán Jiménez, G. I., Leonelli, G., & Millahual, O. (2024). Transformaciones digitales para un aprendizaje profundo en la formación de ciencias agrícolas. *Idesia (Arica)*, *42*(4), 3-11. https://doi.org/10.4067/s0718-34292024000400003

Conflict of interest

Authors declare that they have no conflicts of interest.

Authors' contribution

All the authors reviewed the writing of the manuscript and approve the version finally submitted.

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