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Original article

# Implementation of the local agricultural innovation system based on a plan of actions

## Implementación del sistema de innovación agropecuaria local a partir de un plan de acciones

## Implementação do sistema local de inovação agrícola com base em um plano de ação

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**ABSTRACT**

The work reflects the current state of the agricultural context and local innovation in the department of Sustainable Agroecosystems Management of the National Institute of Agricultural Sciences of Cuba, based on a description of its potentialities and weaknesses, therefore, the general objective is: To design an action plan for the implementation of the Local Agricultural Innovation System in the department of Sustainable Agroecosystems Management. Instruments such as surveys, interviews and discussion groups were applied. The final result of this study is the action plan for the implementation of the Local Agricultural Innovation System in the department and its contribution lies in the participative conception of the different actors, besides being considered flexible and adaptable to other contexts in the center. The work provides the theoretical background that, together with the characterization of the department, constituted the essential basis for the diagnosis that identified the key variables that are influencing the problems that exist in the department, which limit the implementation of the innovation system in the short term. Likewise, barriers that still

persist as an improvement of the Economic Model that contribute to this situation were analyzed and strategic objectives were identified to comply in the short term with the proposed strategy, focused mainly on innovation and the minimization of some of the identified barriers, which finally lead to propose an action plan to materialize activities to implement the local agricultural innovation system in the department.

**Keywords:** scientific innovation; participation; institution; change and innovation system.

**RESUMEN**

El trabajo refleja el estado actual que presenta el contexto agropecuario y de innovación local en el departamento de Manejo de Agroecosistemas Sostenibles del Instituto Nacional de Ciencias Agrícolas de Cuba a partir de una descripción de sus potencialidades y debilidades, por ello se presenta como objetivo general: Diseñar un plan de acción para la implementación del Sistema de Innovación Agropecuaria Local en el departamento de Manejo de Agroecosistemas Sostenibles. Se aplicaron instrumentos como: encuestas, entrevista y grupos de discusión. El resultado final de este estudio es el plan de acción para la implementación del Sistema de Innovación Agropecuaria Local en el departamento y su aporte radica en la concepción participativa de los diferentes actores, además de considerarse flexible y adaptable a otros contextos en el centro. El trabajo aporta los antecedentes teóricos que, conjuntamente con la caracterización del departamento, constituyeron la base esencial para realizar el diagnóstico que identificaron las variables clave que están incidiendo en los problemas que existen en el departamento, que limitan la implementación del sistema de innovación a corto plazo. Igualmente, se analizaron barreras que aún persisten como perfeccionamiento del Modelo Económico que contribuyen a esta situación y se identificaron los objetivos estratégicos para cumplir en el corto plazo con la estrategia propuesta, enfocada fundamentalmente a la innovación y la minimización de algunas de las barreras identificadas, que conllevan finalmente a proponer un plan de acción para lograr materializar actividades para implementar el sistema de innovación agropecuaria local en el departamento.

**Palabras clave:** innovación científica; participación; institución; cambio y sistema de innovación.

**RESUMO**

O trabalho reflete o estado atual do contexto agrícola e da inovação local no departamento de Gestão Sustentável de Agroecossistemas do Instituto Nacional de Ciências Agrárias de Cuba, com base em uma descrição de seu potencial e de seus pontos fracos. O objetivo geral do estudo é elaborar um plano de ação para a implementação do Sistema Local de Inovação Agrícola no departamento de Gestão Sustentável de Agroecossistemas. Foram aplicados instrumentos como pesquisas, entrevistas e grupos de discussão. O resultado final deste estudo é o plano de ação para a implementação do Sistema Local de Inovação Agrícola no departamento e sua contribuição está na concepção participativa dos diferentes atores, além de ser considerado flexível e adaptável a outros contextos no centro. O trabalho fornece a base teórica que, juntamente com a caracterização do departamento, constituiu a base essencial para o diagnóstico que identificou as principais variáveis que estão influenciando os problemas existentes no departamento, que limitam a implementação do sistema de inovação no curto prazo. Da mesma forma, foram analisadas as barreiras que ainda persistem como um refinamento do Modelo Econômico que contribuem para essa situação e foram identificados os objetivos estratégicos para cumprir, no curto prazo, a estratégia proposta, focada fundamentalmente na inovação e na minimização de algumas das barreiras identificadas, o que finalmente levou à proposta de um plano de ação para alcançar a materialização de atividades para implementar o sistema local de inovação agrícola no departamento.

**Palavras-chave:** inovação científica; participação; instituição; mudança e sistema de inovação.

## INTRODUCTION

Cuba is working in the search for the development of the agricultural sector, as well as in the use of innovation to achieve this purpose. For this reason, the country has taken off in the formation of projects that contribute to this, among which we can mention the Local Agricultural Innovation Project (PIAL in Spanish)), which is supported by international institutions such as the Swiss Agency for Cooperation and Development (Rodríguez Borroto et al., 2021).

The Local Agricultural Innovation System (SIAL in Spanish) is the solution proposed by the PIAL, which consists of organizing the operation of agrifood chains locally so as to direct the limited resources available for research to the specific needs of farmers and stakeholders in the production

chains; it can be used to take advantage of the local knowledge of farmers and other stakeholders to stimulate diversification and increase production in a sustainable way; it is facilitated the access of production units and other stakeholders in the chains to the knowledge of their counterparts in the territory, universities and research centers. It can therefore be an effective tool for local governments to contribute to the management of their development strategies (Pacheco Correa et al., 2022).

The mission of the Department of Sustainable Agroecosystems Management (MAS in Spanish) of the National Institute of Agricultural Sciences (INCA in Spanish) is to propose sustainable agronomic alternatives on agroecological bases to improve the agricultural environment of localities and reduce the adverse effects of climate change, This paper provides theoretical and practical contributions for the implementation of the SIAL, using a methodology that can be applied in different analyses. From the practical point of view, an action plan is established to develop activities to strengthen the existing system in the department through the SIAL, a tool that will help identify gaps and strengthen innovation in its lines of work, based on the participation of actors, institutions, and producers with whom it develops joint research projects that contribute to the solution of problems related to agricultural activity. Taking into account the above and the importance of training innovation facilitators to implement the SIAL in the department, the objective of this work was to design an action plan for the implementation of the Local Agricultural Innovation System in the department of Sustainable Agroecosystems Management.

## MATERIALS AND METHODS

The theoretical-methodological contribution was based on the identification and analysis of the context in the department of MAS that hindered or facilitated the application of the SIAL to strengthen and dynamize development seen from a new model of local agricultural innovation and from the practical point of view establishes an action plan to strengthen its implementation.

To begin the study, a documentary analysis was conducted to gather data and information to characterize the department based on the methodological basis of the Participatory Strategic Diagnosis with a comprehensive approach on four basic processes of the organization: Social, Strategic, Technological and Administrative, which allowed clarifying the problems that had to be faced during the change process and identifying the strengths and opportunities that could be used to promote this process and the weaknesses and threats that could be hindered.

This study was carried out from an integral research approach, which had as its methodological basis the dialectical-materialistic method. In this sense, other methods were used, such as:

**Theoretical:** They made possible the conceptual interpretation of empirical data and allowed the interpretation of theories. They were used in the construction and development of theories when explaining the facts that made it possible to delve into the essential relationships of unobservable processes.

**Logical history**: It allowed the study of the trajectory, development and evolution of innovation in the department.

**Analytical-synthetic**: They were used to determine and formulate the scientific problem from the social practice, starting from what is known, in this case PIAL and the regularities that have been confronted for the implementation of SIAL in the department. They were also used in the elaboration of the action plan proposal. For the collection of information, the following was applied:

- **Participant observation:** This made it possible to obtain information about SIAL and knowledge of it in the department. It was also used as a starting point for the use of other empirical methods.
- **The survey** made it possible to receive information, opinions, and evaluations that, when processed, led to conclusions about the knowledge of SIAL in the department at present.
- **The interview:** it allowed obtaining information on the deficiencies that existed in the department on the subject.
- **Discussion group**: allowed socializing and collecting criteria from different people on the object of research, integrating it with the data provided by the key actors.

The procedures used are based on the quali-quantitative methodology from a mixed design perspective. Instruments were also used to analyze and reflect the data from the technique of simple graphs that are used to represent figures or diagrams that respond faithfully to certain data collected. In this case, bar and pie charts were used, created in Microsoft Excel and the statistical program Statgraphics PLUS version 5.1. The sample used was intentioned: for the surveys, a sample of 14 workers was taken, representing 46.66% of the department's workers, including specialists (3) and technicians (2), as well as workers (2) and researchers (7). With respect to the interviews, the sample consisted of 13 workers, specialists (2), technicians (1), managers (1), workers (4), researchers (4) and administrative and service workers (1). Subsequently, methodological

triangulation was carried out to contrast the information resulting from the different instruments applied. This made it possible to reach generalizations and identify the main strengths and weaknesses in the department.

Problems were defined as an undesired situation that needs to be changed in order to achieve a sustained development of each given process. The surveys and interviews applied were processed by the percentage and Chi-square analysis method, which made it possible to obtain more representative and concrete information.

## RESULTS AND DISCUSSION

The present research was carried out in 2020, in the department of Sustainable Agroecosystems Management belonging to the National Institute of Agricultural Sciences, located in the municipality of San José de las Lajas, Mayabeque province and which fundamental line of research is the holistic study of agroecosystems in the direction of sustainability, from the strengthening of innovation systems.

The proposal to implement the SIAL based on an action plan was framed in the MAS department and is intended to be used permanently, and may be subject to changes based on the eradication or minimization of weaknesses. This required the conscientious participation of all those involved in order to efficiently achieve the objectives pursued.

### Survey analysis

When analyzing the frequency with which activities are organized with the department to facilitate the identification of its problems and the contracting of solutions, in addition to the most used mechanism for this action, the results showed that these are not systematic and the activities are not well defined to identify problems and their solutions, since it is not possible to distinguish the periodicity of these activities or the most used mechanisms, and the answers given do not coincide in general.

The above constitutes a process of an informational nature that in recent decades has generated the attention of multiple disciplinary areas, making necessary the importance of activities or meetings where problems are identified for the solution of these (Rodríguez Cruz & Pinto, 2018).

Figure 1 shows the results of the surveys conducted with the total number of workers sampled (14), of which 8 mentioned that the frequency with which activities were organized to detect departmental problems was monthly, two quarterly, three annually and one did not respond. For the most used mechanisms, 36% responded that it was through monthly meetings, 36% through technical diagnostic visits, 21% responded with other mechanisms; of these, 7% responded that it was by office with the boss, 14% by the scientific commission and the remaining 7% responded that they had no criteria.

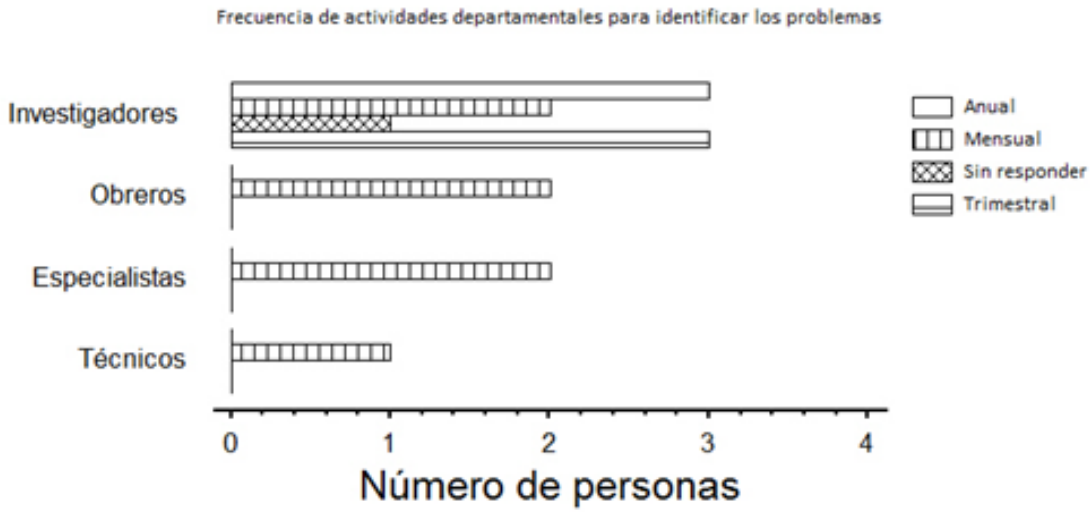


**Figure 1.** Frequency with which departmental activities are carried out to identify problems
Source: Own elaboration

In the case of the actors that participate in innovation management, there is no uniform criterion as to which are the actors in current management. It should be noted that some of the actors that should participate are those that currently do participate, which denotes a lack of knowledge about innovation management in the department (Figure 2).

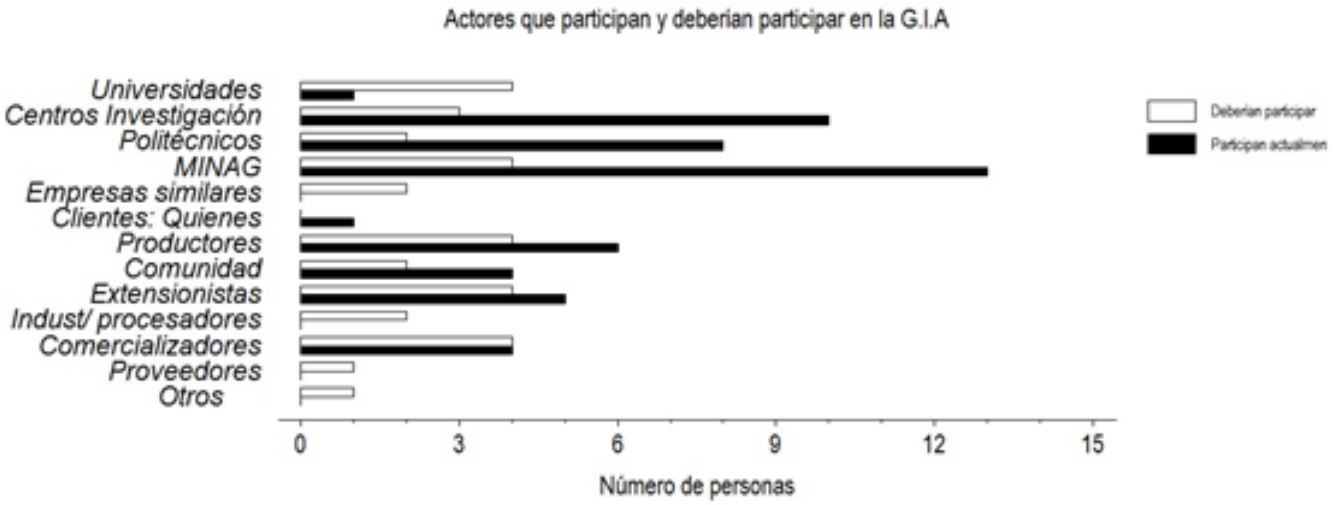


**Figure 2.** Actors that participate and should participate in the management of agricultural innovation

Source: Own elaboration

In this sense, the SIAL seeks to promote and systematize a set of practices and methodologies to find innovative solutions in agriculture based on the involvement of local stakeholders (Ortiz Pérez et al., 2016, 2021); therefore, they constitute a proposal on how to implement a knowledge management and development system in a horizontal and participatory manner (Romero Sarduy et al., 2018). In parallel, they assume a broad, theoretical-practical innovation model, based on capacity building and the consolidation of innovation management practices, under the philosophy: doing-using-interacting.

When the respondents answered about the defined processes that characterize the management of agricultural innovation, 71% of the respondents (10) stated that the processes are defined, however, 86% (13) could not relate the different processes, but contradictorily 71% stated that they correspond to the reality of the department. On the other hand, 100% of the respondents could not explain why they correspond to the reality and needs of the organization (Figure 3).

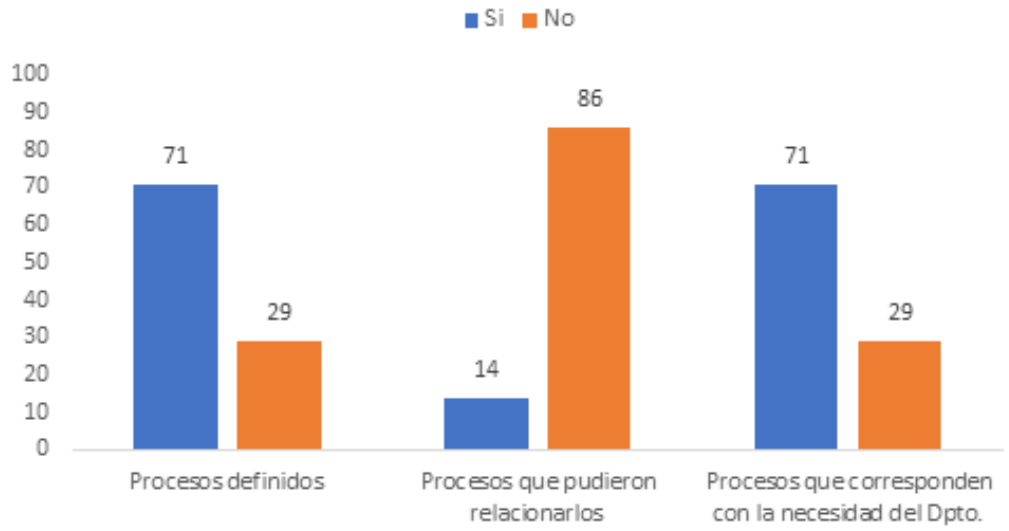


**Figure 3.** Processes that characterize the management of agricultural innovation in the department

Source: Own elaboration

This result is of great importance since the productive and innovative arrangements and systems represent, fundamentally, a frame of reference for understanding the processes of generation, dissemination and use of knowledge and those of the productive and innovative dynamics (Garcés Castañeda et al., 2020). It is a matter of assuming innovation as a dynamizing element of local development from the relationships between municipal governments, popular councils, territorial actors, enterprises, community processes and socio-cultural practices (Pérez Gutiérrez et al., 2021; Stewart Santos et al., 2020). Its maximum use depends on this premise (Núñez Jover & Alcázar Quiñones, 2016).

For the mechanisms considered necessary to develop the management of agricultural innovation in the organization, there is no uniform criterion. In this case, some mechanisms that are currently used are suggested as mechanisms that should be applied, excluding the mechanisms that are currently used and only 1 of them mentioned scientific and technical services as other mechanisms that could be used (Figure 4).

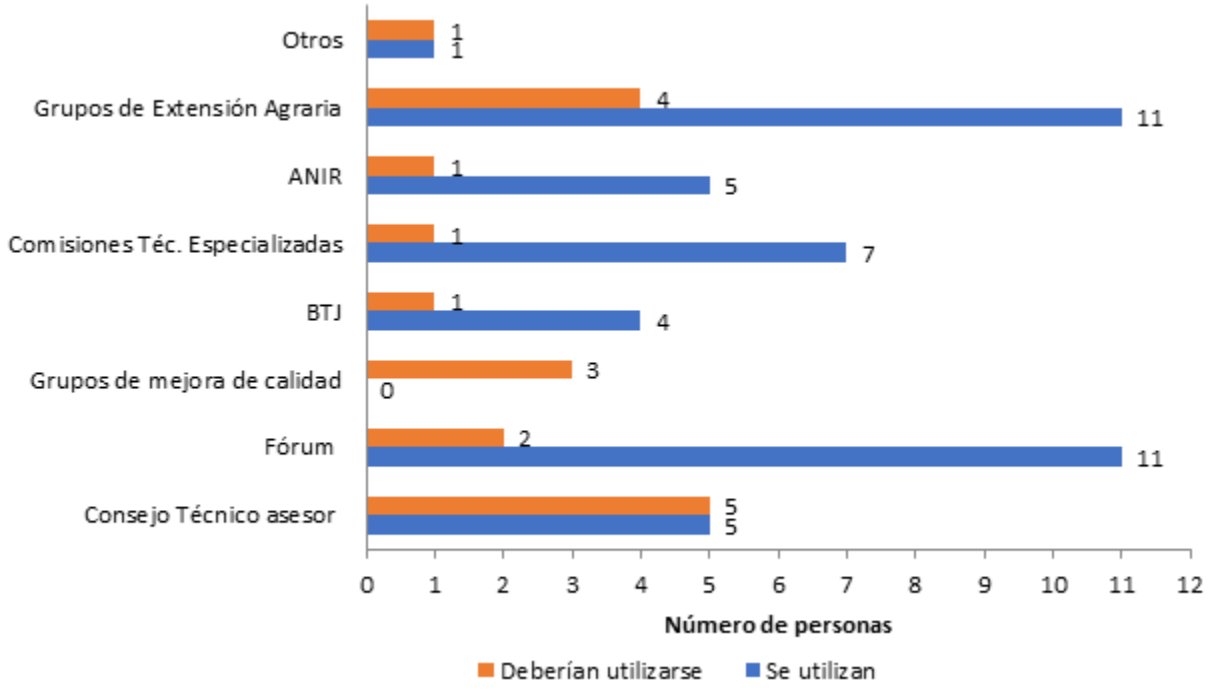


**Figure 4.** Mechanisms necessary to promote interaction and management of innovation
Source: Own elaboration

In the analysis of which mechanism was considered the most suitable to facilitate the introduction of the results of science, there was a lack of knowledge of the benefits of each mechanism and of their use in an integral manner, in addition to the mechanism of economic stimulation to the introducers for their results. In general, 9 answered that the mechanism was constituted by projects, 6 by programs, 12 by extension actions, 7 by dissemination, 10 by leading producers and only 2 people mentioned other mechanisms (technical scientific services) (Figure 5).

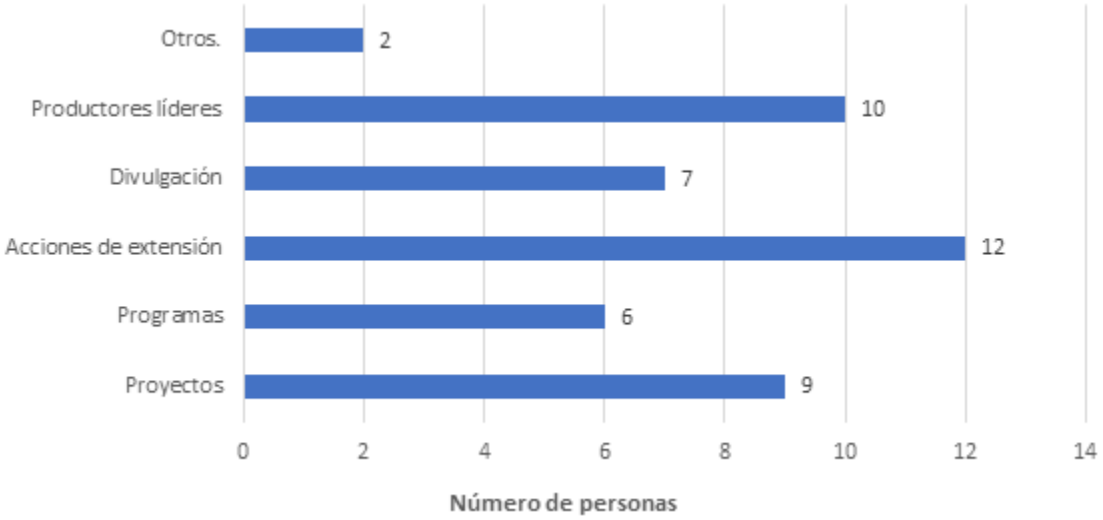


**Figure 5.** Mechanisms considered to facilitate the introduction of science results
Source: Own elaboration

Among the main difficulties affecting the functioning of the agricultural extension activity, 57.1% of the respondents (8) agreed that the difficulties were due to organizational and structural problems and lack of training, and 64.2% (9) stated that the links with the farmer cooperative sector should be increased. It should be noted that no one added other causes.

With respect to the criteria of the respondents for the implementation of the SIAL in the department, there was no uniformity in the criteria, and most of the respondents did not express any criteria. Only two people mentioned as limitations the increase in extension activities, training, and logistical difficulties (transportation, fuel), and one person mentioned as limitations that there were few spaces for presenting the results, and that not all the workers were involved in introducing the different results of the science and that there was no encouragement for the results obtained.

**Analysis of interviews**

When the different employees of the department were interviewed about who directs innovation management, 77 % (10) of the respondents answered that it was directed by the organization's management, 7.6 % (1) said that the production area and 15.3 % (2) said that it was another area, but they could not identify it. Twenty-three percent of the personnel interviewed do not have a uniform criterion. In the case of whether or not there is a model for innovation management and

whether or not it is represented, documented and shared, 9 (69.2 %) of the respondents said that there is an innovation management model and 5 (38.2 %) said that there is not. When asked if it was documented, shared and represented, 8 of the respondents (61.5 %) could not answer (Figure 6).

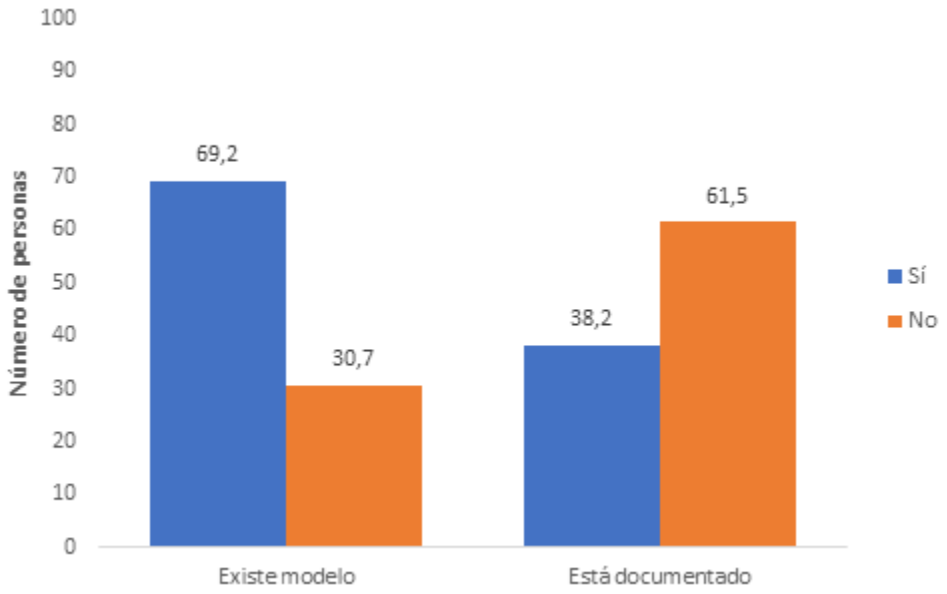


**Figure 6.** Existence of a model for innovation management in the MAS department
Source: Own elaboration

When interviewed about whether the processes that characterize the management of agricultural innovation are defined in the department and whether they could describe them, 46.1% (6 interviewees) did not know about the existence of processes that characterize management. They were defined and described by 15.3% (2 interviewees), 84.7% (11 interviewees) could not describe them. The interviewees who were able to describe them mentioned among the processes the departmental scientific commission, the results introduction group, the PIAL, the INCA Extension Directorate and the provincial agricultural front. As to whether these processes correspond to the reality and needs of the department, 46.2% (6 respondents) answered yes and only 7% (3 people) explained why, while 53.8% (7) did not answer and could not explain why. Among the explanations, they mentioned participation in the bioproducts project, synergy with producers and the role of the department on the agricultural front.

This form of participation and collective construction aims to promote the empowerment of the actors, by being part of the solution to the problem, which represents a lever of change for the successful development of the SIAL (Núñez Jover & Proenza Díaz, 2019). Specifically, it promotes a new system of relationships with a participatory, dialogic and horizontal sense, from the actors involved, with them and for them. At the same time, it generates learning and strategic alliances for the empowerment of local and community subjects.

Of the people surveyed, 6 expressed that they were aware of the generalization plan involving the department and 7 that they were not aware of it, representing 53.8 % of the respondents. On the other hand, only 6 people (46.2 %) expressed that they were not aware of the innovation projects involving the department (Figure 7).

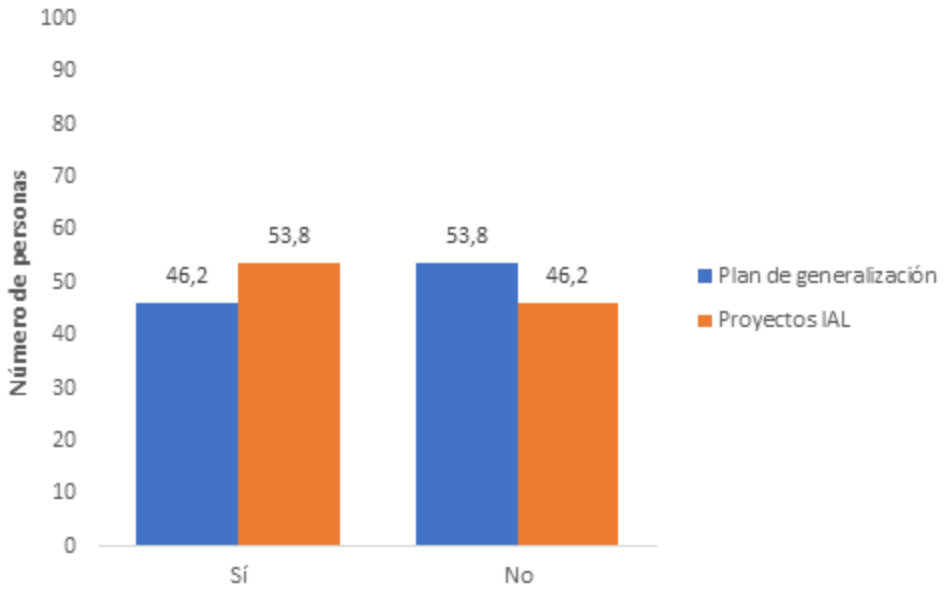


**Figure 7.** Knowledge about the generalization plan and local agricultural innovation projects involving the department
Source: Own elaboration

When analyzing the mechanisms considered necessary to promote interaction and management of innovation, the greatest number of those interviewed answered that it was the Science and Technology Forum, but not the Technical Advisory Council and the Agricultural Extension groups. Among the people interviewed, some of them referred that the Technical Advisory Council, the

Quality Improvement Groups and the Specialized Technical Commissions should be used to a greater extent, representing the non-uniformity in the criteria and knowledge in this regard.

After the interviews were conducted, only 4 respondents, representing 30.8%, were able to answer about the process of introduction and generalization of the research results, among which are: the actions developed by the colleagues who are in charge of the introduction and the researchers directly in close connection with the National Association of Small Farmers, the Ministry of Agriculture, the Federation of Cuban Women and the government through the PIAL, in addition, on the agricultural front it is introduced through the research results obtained from the projects, by the personal way of the researcher, by some punctual demand of the Ministry of Agriculture and that is coordinated with producers and productive enterprises to which the research results are taken. 69.2% (9 respondents) did not answer.

With respect to the limitations of the implementation of the SIAL in the department, 92.3% expressed their opinion in a very dispersed manner. Among the limitations mentioned were: the need for more links with producers and productive entities, few spaces for the presentation of results in the department, the lack of mechanisms to stimulate workers, and among the most representative were: the lack of training and unlimited difficulties (lack of knowledge of the reality of food production at present, transportation).

**Rationale of the action plan for the implementation of the SIAL in the MAS department**

Innovation enhances the management of public administration for local development, but this requires an integral interpretation of these processes, so that they form part of it. To talk about local development requires understanding it as a phenomenon of objective, multifactorial, multidimensional and multifactorial reality in which, in addition, several disciplines are involved. It does not depend solely on our expectations and aspirations, but on the realization of the potential for change. The effort invested in the processes and the behavior of local actors, as well as the results of the economic, social, cultural, productive and environmental dynamics, play an important role in this process. The existence of Higher Education institutions in Cuban municipalities, Municipal University Centers, is an undeniable strength to promote Local Development. This favors, in the first place, the process of knowledge management and allows strengthening interrelationships and synergies with other Higher Education Centers, Science and Technological Innovation Entities or Research Centers of the region and the country, which contribute to the transfer of knowledge and

technologies necessary for the development of the territories (Blanco Encinosa, 2017; Pérez García et al., 2019).

Agricultural innovation on a sustainable basis is one of the pillars on which the production and productivity of the agricultural sector in any country is based, but Cuba, although it has a large number of highly qualified universities and research centers and also a scientific capacity installed in the Municipal University Centers, associations and other actors, has not achieved a takeoff of agricultural production in recent years, which indicates in general terms that the numerous research and large amount of knowledge treasured by these institutions do not reach a critical mass of farmers or have a weak articulation with their needs (Núñez Jover et al., 2020).

Innovation is the capacity to change or transform a product, process or management system, regardless of whether it is a radical modification or a small improvement, as long as the result reaches its final successful exploitation (improving the competitive position of enterprises, increasing the social welfare of citizens, favoring sustainable growth). Innovation is the application of new knowledge in productive or organizational processes. It occurs when there is a social appropriation of knowledge, ideas, practices and technologies, i.e. when it translates into a change that is useful and beneficial in the productive process. To be considered an innovation, the novelty implemented must be something new for that context and not necessarily for the world (Pérez Gutiérrez et al., 2021).

The innovation process occurs, to a large extent, within "innovation systems" made up of organizations and actors, both private and public, that are connected in various ways and bring together the technical, commercial and financial competencies and inputs necessary for innovation. To achieve this requires new capabilities and learning-by-doing.

**Proposal for the implementation of the SIAL in the department of MAS (Action Plan)**

Based on what has been seen so far and the importance of these processes in the agricultural context, it is necessary to propose an action plan for the implementation of the Local Agricultural Innovation System in the department of MAS.

In order to solve the problem in the medium term, it is necessary to develop an action plan based on more objective actions as a result of this research, including the creation of a group of facilitators in the department so that the different activities proposed can flow more easily.

The actions should be developed by a facilitation group, together with other actors, through a relationship based on dialogue, participation and feedback of theoretical and practical knowledge. The following proposal for actions is derived from this (Table 1):

**Table 1.** Action plan for the implementation of the Local Agricultural Innovation System in the department of MAS

| Actions | Main activities | Responsible |
|---|---|---|
| Create facilitation team to promote all aspects related to SIAL | • Conduct a sensitization workshop for the creation of a team of SIAL facilitators in the department.<br>• Conduct exchanges, workshops, meetings for systematic updating to define the objectives and other aspects of importance for the implementation of the SIAL. | • Head of department<br>• PIAL Mayabeque Coordination<br>• SIAL Facilitators Team |
| Convene a meeting with the department's employees | • Present at a department meeting the activities where problems are identified and solutions are proposed.<br>• Show the annual schedule of these meetings to the workers | • Head of department |
| Define the mechanisms currently used for innovation management and the definition of those that should be used today. | • Use the department's socialization spaces to relate the mechanisms currently used for innovation management.<br>• Hold a working meeting where, based on the results of the interviews and surveys carried out, an agreement is reached with all employees on the mechanisms that should be used and | • SIAL Facilitators Team |

| | | |
|---|---|---|
| | the actions necessary to influence their compliance | |
| Create spaces in department meetings where aspects related to the introduction and generalization are periodically reported and discussed. | • Inform workers of aspects related to the introduction and generalization of the results of the center's science and the department's relationship with them, as well as the situation of the territory in socialization spaces (members' assemblies, departmental work meetings). | • Head of department |
| • Disseminate how the demands of the productive base are determined.<br>• Exchange with the Extension and Production Department. | • Prepare brochures or other informative documents on how demands are determined in the productive base.<br>• Bringing together the different working groups | • SIAL Facilitators Team |
| Elaborate the generalization plan involving the department, as well as the innovation projects. | • Hold a working meeting to present the generalization plan and the innovation project involving the department.<br>• Report on the fulfillment of the generalization plan and innovation project involving the department. | • Head of department |
| Define with the workers: | • Conduct audiovisual activities to document, inform and motivate in all aspects related to innovation management corresponding to the | • SIAL Facilitators Team |

| | | |
|---|---|---|
| • Who leads innovation management in the department?<br>• Model that exists and whether it is represented, documented and shared in the department.<br>• Innovation management actors in the department and the processes defined at this level. | department and the situation of the locality<br>• Participate in the Provincial Agricultural Front. | |

Source: Own elaboration

For the implementation of the system of actions, it is suggested to use the methodology of popular education, seen from its pedagogical approach in the orientation of processes of knowledge construction and socialization that includes practices, knowledge, socio-cultural dynamics and interactions to transform society from inclusive citizenship and cultural resistance (Torres Carrillo et al., 2022); since it promotes a liberating ethic that values the human being as a subject of knowledge and transformation, from a horizontal relationship with the facilitation team.

The diagnosis identified the key variables that are affecting and limiting the implementation of the SIAL in the department, as well as the main deficiencies, such as a lack of knowledge of the department's workers in basic aspects (scope and objectives of the SIAL) for the development of its implementation. The action plan proposed in this work covers the main activities that will allow the implementation of the SIAL tools, as well as the use of easily accessible technologies and methodologies based on agroecological foundations.

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**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.