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Original article

# Methodological guidelines for the effective management of scientific-research leadership in local development actors

## Pautas metodológicas para la gestión efectiva del liderazgo científico-investigativo en actores del desarrollo local

## Diretrizes metodológicas para a gestão eficaz da liderança em pesquisa científica em atores do desenvolvimento local

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**ABSTRACT**

Scientific and research leadership is key to managing local development based on a science and innovation-based government management system. The objective of this study was to determine methodological guidelines for the effective management of scientific-research leadership in local development actors. The study had a qualitative approach and explanatory scope, using surveys and

*Translated from the original in Spanish*

focus groups as data collection techniques. The sample was non-probabilistic (convenience sampling) and consisted of 49 subjects (experts and graduate students). Six essential qualities were identified: teamwork, ethics, proactivity, creativity, mobilizing agent, and communication capacity; three key indicators of scientific-research leadership: research knowledge and competence, scientific activism, and digital identity and Information and Communication Technology competencies; and seven guidelines for the effective management of scientific-research leadership in local development actors were determined: 1) Institutionalize the process of scientific-research leadership management in organizations, 2) Determine the key areas of science management, 3) Conduct a diagnosis of the context with an emphasis on strengths and opportunities, 4) Identify individuals with the qualities to exercise scientific-research leadership, 5) Establish the institutional work system and work plans for the identified leaders, based on the achievement of organizational goals, 6) Establish an organizational training and capacity-building system based on the qualities and indicators for scientific-research leadership, 7) Establish a system for stimulating and monitoring scientific-research leadership at the organizational level.

**Keywords:** science; local development; management; innovation; leadership.

## RESUMEN

El liderazgo científico-investigativo resulta clave para la gestión del desarrollo local sustentado en el sistema de gestión de gobierno basado en ciencia e innovación. El objetivo de este estudio fue determinar pautas metodológicas para la gestión efectiva del liderazgo científico-investigativo en actores del desarrollo local. El estudio tuvo un enfoque cualitativo y alcance explicativo, se emplearon la encuesta y el grupo focal como técnicas de recogida de información. La muestra fue no probabilística (por conveniencia), estuvo constituida por 49 sujetos (expertos y estudiantes de posgrado). Se determinaron seis cualidades esenciales: trabajo en equipo, ética, proactividad, creatividad, agente movilizador y capacidad de comunicación; tres indicadores clave del liderazgo científico-investigativo: conocimiento y competencia investigativa, activismo científico, e identidad digital y competencias en Tecnologías de la Información y la Comunicación, y se determinaron siete pautas para la gestión efectiva del liderazgo científico-investigativo en los actores del desarrollo local: 1) Institucionalizar el proceso de gestión del liderazgo científico-investigativo en las organizaciones, 2) Determinar las áreas clave de gestión de la ciencia, 3) Realizar el diagnóstico del contexto con

énfasis en las fortalezas y oportunidades, 4) Identificar a los sujetos con cualidades para ejercer el liderazgo científico-investigativo, 5) Establecer el sistema de trabajo institucional y los planes de trabajo de los líderes identificados, en función del logro de las metas organizacionales, 6) Establecer un sistema de formación y capacitación organizacional en función de las cualidades e indicadores para el liderazgo científico-investigativo, 7) Establecer un sistema de estimulación y control del liderazgo científico-investigativo a nivel organizacional.

**Palabras clave:** ciencia; desarrollo local; gestión; innovación; liderazgo.

**RESUMO**

A liderança científica e de pesquisa é fundamental para a gestão do desenvolvimento local com base em um sistema de governança orientado pela ciência e inovação. O objetivo deste estudo foi determinar diretrizes metodológicas para a gestão eficaz da liderança científica e de pesquisa entre os atores do desenvolvimento local. O estudo empregou uma abordagem qualitativa e de escopo explicativo, utilizando questionários e grupos focais como técnicas de coleta de dados. A amostra foi não probabilística (por conveniência) e composta por 49 participantes (especialistas e estudantes de pós-graduação). Seis qualidades essenciais foram identificadas: trabalho em equipe, ética, proatividade, criatividade, capacidade de mobilização e habilidades de comunicação. Três indicadores-chave de liderança científica e de pesquisa foram identificados: conhecimento e competência em pesquisa, ativismo científico e identidade digital e habilidades em Tecnologias da Informação e Comunicação. Sete diretrizes também foram estabelecidas para a gestão eficaz da liderança científica e de pesquisa entre os atores do desenvolvimento local: 1) Institucionalizar o processo de gestão da liderança científica e de pesquisa dentro das organizações; 2) Determinar as principais áreas da gestão científica; 3) Realizar uma análise contextual com ênfase em pontos fortes e oportunidades; 4) Identificar indivíduos com as qualidades necessárias para exercer a liderança científica e de pesquisa; 5) Estabelecer o sistema de trabalho institucional e os planos de trabalho para os líderes identificados, com base na consecução dos objetivos organizacionais; 6) Estabelecer um sistema organizacional de treinamento e capacitação baseado nas qualidades e indicadores de liderança científica e de pesquisa; e 7) Estabelecer um sistema para estimular e monitorar a liderança científica e de pesquisa em nível organizacional.

**Palavras-chave:** ciência; desenvolvimento local; gestão; inovação; liderança.

## INTRODUCTION

Leadership is the process through which an individual influences others to achieve a common goal, or the capacity of some individuals to be followed by others in the pursuit of a common goal. According to Cąliş and Buÿükakinci (2019, cited in Geraldo Campos et al., 2020, p. 157), "a person who uses their influence, capacity, and knowledge to guide groups in achieving their goals is defined as a leader."

Leadership is a topic that has been widely addressed in scientific literature. The first theoretical approach to this topic was written in 1841 and dealt with the theory of the great man (Sivaruban, 2021). Since then, multiple leadership theories have proliferated: trait theory, behavioral theories, contingency theory, leader-member exchange theory, path-goal theory, and transformational leadership theory, among others (Alcázar Cruz, 2020).

Kurt Lewin is one of the most relevant and cited theorists on the subject. In an article published by him in 1944, he identifies various contradictions surrounding the study of leadership: he mentions the different perspectives between democratic and authoritarian leadership styles, as well as between their innate or learned nature (Lewin, 1944). MacGregor stands out as one of the most cited contemporary researchers, mainly for establishing the distinction between transactional and transformational leadership (Burns, 2012). Likewise, Fiedler's contingency model highlights leadership as an emerging process of the relationship between leaders and followers, where the situational aspect plays a relevant role (Barón, 1989).

In a theoretical review published by Geraldo Campos et al. (2020), three main theories of leadership are identified: personalist, situational or functionalist, and contingency. They also describe four approaches to leadership (trait, behavioral, contingency, and emergent), which refer to general patterns within which leadership styles (behavioral patterns that characterize the leader) operate and manifest themselves. In addition, it shows that the most recognized styles are authoritarian, democratic, *laissez faire,* bureaucratic, charismatic, informal, formal, task-oriented, people-oriented, situational, transactional, and transformational.

The analysis of leadership allows to identify a diversity of theories, approaches, and styles that can overlap or mix depending on the taxonomies used, which some authors assume as an approach, while others define as theories or leadership styles. This situation surrounding the theoretical understanding of leadership makes it very difficult to arrive at a stable and homogeneous definition of the term. In this regard, Avolio (2007) and Deure et al. (2011), cited in Sivaruban (2021), recognize that leadership styles vary from culture to culture, from situation to situation, and from West to East, as not all are the same. Consequently, the theoretical integration of leadership has not yet been completed.

Nevertheless, the academic community tends to assume that leadership is a key process for the successful development of multiple social processes, and currently, three fundamental theories are commonly recognized: trait theory, which emphasizes the personal qualities of the leader (with roots in the great man theory); behavioral theory, which focuses on the leader learning an arsenal of "adjustable" responses to environments; and contingency theory, which recognizes that leader behavior needs to be constantly adjusted to situations, as previously learned effective responses or leadership styles may not be appropriate in new situations or circumstances (Fiedler, 2006, cited in Sivaruban, 2021).

The state of the art in leadership indicates that there is no single theory, type, or style of leadership that is suitable for all contexts, groups, or activities. In fact, it is recognized that historical conditions can influence the emergence of new leadership styles. For example, Sivaruban (2021, p. 64) points out that, as a result of the COVID-19 pandemic, a new style called "resilient leadership" has emerged.

Social practice related to scientific activity has also conditioned the existence of scientific or scientific-research leadership (LCI in Spanish) as a unique type. Ortiz Torres and Viamonte Garrido (2020) highlight the necessary distinction of this type of leadership, since its nature and field of activity differentiate it substantially from others.

Piña Borrego (2022, p. 4) asserts that LCI refers to the function exercised by a person who, due to their academic training, research experience, scientific results, initiative, creativity, activism, superior performance, charisma, and unifying work, is capable of motivating, bringing together, and guiding other researchers in the completion of research projects.

Similarly, Ortiz Torres and Viamonte Garrido (2021) emphasize that LCI implies the ability to convene, bring together, guide, and influence other members of research teams through personal example in their scientific performance, without the need for formal or administrative mediation.

LCI is not limited to university settings, but it is related to activities typical of those contexts. The high performance of universities is often the result of the scientific, educational, and innovative contributions of scientific leaders (Piñón González, 2020). This highlights the value of LCI, even though its nature and form are different from leadership in the broad sense.

LCI is distinguished by the "logic and dynamics specific to its *ethos* and field of activity" (Ortiz Torres & Viamonte Garrido, 2020), which are usually manifested in professional academic, scientific, and research activities.

For this reason, academics propose indicators or criteria to identify and, consequently, stimulate LCI. Ortiz Torres et al. (2013, cited in Ortiz Torres & Viamonte Garrido, 2020) propose scientometric and altmetric indicators that account for the activism and impact of researchers. They consider that participation in scientific projects, the publication index, the inverse coefficient of sole authorship, citation indices, the number of academic papers, the internationalization factor, the number of academic followers and readings on ResearchGate, and the interest index allow scientific leaders to be identified.

Subsequently, these same authors (Ortiz Torres & Viamonte Garrido, 2021) include other indicators: scientific awards, lead authorship of articles published in high-impact journals, the proportion of articles in international databases, publications as a continuation of doctoral theses, the perception of the relevance of publishing only in peer-reviewed journals, and the number of theses supervised.

Although these indicators do not cover all the aspects that can be assessed to identify and determine the level of LCI, they provide insights that allow professionals to be differentiated from one another in terms of fulfilling the LCI mission in academic environments: "to prepare high-level professionals so that they can successfully address the problems associated with social development" (Piñón González, 2020, p. 4).

Now, returning to the idea that the exercise of leadership is conditioned by socio-historical factors, it is possible to recognize the need, usefulness, and importance of LCI in the performance of local

development actors (ADL in Spanish) in the new science and innovation-based government management system promoted as Cuban government policy (Díaz-Canel Bermúdez, 2021).

According to this policy, successful government management requires transdisciplinary and intersectoral approaches (Díaz-Canel Bermúdez et al., 2020) and demands a commitment to science and innovation as competitive advantages for development. This commitment is based on the concepts of territorial capital (Camagni & Capello, 2013) and situated knowledge (Díaz-Canel Bermúdez, 2021; Fernández González & Núñez Jover, 2020).

Camagni and Capello (2013) address various components of territorial capital and recognize research and development as key tools for achieving a knowledge society. They highlight the importance of cooperation between actors operating at the territorial level and focus on relationships that contribute to the transfer of research and development, scientific ventures, or university spin-offs. They also assume that territorial capital includes private know-how, recognizing that scientific knowledge and technological innovation are not exclusive to universities and science, technology, and innovation entities, but can form part of cooperation networks between all actors and constitute components of social capital: institutions around scientific activity, behavior models, values, among other aspects.

Likewise, the contextualization of the concept of situated knowledge allows to recognize the knowledge sector in the broadest possible sense (Díaz-Canel Bermúdez, 2021). This means that, although universities and science, technology, and innovation entities play a leading role, other actors are not excluded; on the contrary, farmers, self-employed workers, and other actors are required to integrate scientific management into the performance of their functions. The concept of situated knowledge is anchored in the idea of science that recognizes the importance of context -including the networks of actors that constitute it- in the processes of production, dissemination, validation, and use of knowledge (Fernández González & Núñez Jover, 2020, p. 19).

Consequently, it follows that local development (DL in Spanish) implies that all actors assume roles, functions, practices, or develop scientific and innovative skills, to a greater or lesser extent, according to their mission and type. In short, the success of ADLs in terms of territorial development requires science and innovation management. Therefore, the greater the capacity of ADLs to lead in science and innovation, the more likely they are to succeed. The challenge lies in determining how to manage this leadership among the actors.

To do this, it is necessary to define what is assumed to be an ADL in the Cuban context. In this regard, it should be clarified that the definition of ADLs requires and conditions, at the same time, a position on the concept of DL: the sociopolitical dimension of DL has ADLs at its epicenter and the role they play in relation to the territory.

The configuration of ADLs as key to DL and the need for interaction between them is reflected in the concept offered by Vázquez Barquero (2018, p. 219): DL is "... a process of growth and structural change in which economic and social actors and organizations make investment decisions, exchange goods and services, and enter into agreements and contracts." Thus, both public and private actors, whether individuals or groups (organizations, local institutions, civil society, government), participate in an interactive framework of actions specific to development policies, including science, technology and innovation policies.

Vázquez Barquero's (2018) definition allows to recognize DL as an interactive process between ADLs that take advantage of contextual potentialities and available resources to achieve higher levels of productivity and competitiveness in their production. Therefore, the identification of ADLs involves recognizing them as active local entity, with a local identity, participating in development policies, and aware of their contribution to DL.

Based on these criteria, the concept of ADL proposed by Quispe Fernández et al. (2018, p. 68) is adopted, as these authors recognize the plurality of actors, their active and conscious nature, as well as aspects of local identity. In summary, they define ADLs as: the conglomerate of local people and organizations that are constantly acting and generating change, seeking local development, and that have a relationship of belonging to each other, with a social, economic, and cultural identity; in addition to local knowledge and awareness that drive intervention and action in favor of groups and territories, and these relationships strengthen unity and social interaction.

Thus, both public actors (municipal government, state production and service entities) and private actors (micro, small, and medium-sized private enterprises, cooperatives, self-employed workers, farmers, and civil society [citizens and their various forms of organization]) are identified as ADLs.

In the Cuban public sector, it is generally recognized that "the municipal government is the local actor with the greatest capacity to organize and lead the DL" (Díaz-Canel Bermúdez, 2020, cited in Díaz-Canel Bermúdez et al., 2020). In principle, this condition is anchored in the public power it

enjoys, beyond that of other ADL, although this role has been undergoing a certain redefinition within the local scenario: from the concept of vertical public power to coordination and negotiation leading to articulation between all actors.

In this regard, actions that highlight the role of municipal government in interaction with other actors, including private actors, should be directed, from a political, economic, and sociocultural perspective (including scientific research) toward the creation of a fully participatory environment consistent with democratic integration for the formulation and management of public policies and the actions of local actors (Echavarría, 2017).

At this point, it is clear that the implementation of a science and innovation-based government management system involves the participation of all ADLs; the challenge lies in determining how these actors, including those not usually engaged in science, technology and innovation activities, can promote LCI.

There are previous studies that seek to identify and promote LCI in different contexts. For example, Ortiz Torres and Viamonte Garrido (2020, 2021) conduct studies in university contexts and academic networks; they determine indicators to identify, develop, and evaluate LCI in these spaces and highlight qualities such as charisma, creativity, activism, high academic preparation, prestige, communication skills, and relevant research results, among others.

For their part, Cuba Jiménez and Escribano Hervis (2023) propose content blocks to develop LCI in university students. They highlight essential content for achieving this objective in students: scientifically observing reality, designing and applying data collection techniques, managing scientific and technical information, critically evaluating information, comparing theoretical approaches, assuming and arguing a theoretical position, providing alternatives to problems, and communicating the results of their work.

However, no research has been identified that focuses on LCI management in the diversity of ADLs (with the exception of science, technology, and innovation entities and universities). This is a pressing need in Cuban municipal contexts, as it requires the use of endogenous science and innovation as key inputs for DL. For this reason, the present study, part of the institutional project of the University of Oriente "Scientific management for sustainable local development in Santiago

municipalities," aims to determine methodological guidelines for LCI management in ADL in the context of Cuban municipalities.

## MATERIALS AND METHODS

The methodology used followed the route of ten methodological aspects of epistemic mapping (Deroncele Acosta et al., 2021). The study was based on:

1. Paradigm: dialectical, as it allowed reality to be analyzed as a dynamic and historical process; the hermeneutic principle was assumed, since interpretations of messages carrying meanings were made.
2. Approach: qualitative. This was expressed during the construction of meanings based on the meanings shared and communicated in interactions with the participating subjects.
3. Type of research: basic. It was carried out to determine methodological guidelines on how to enhance a previously defined social process. New knowledge is generated.
4. Type of study: *Grounded* theory. This allowed essential relationships to be revealed in the systems of meanings constructed in spaces of social interaction.
5. Scope: explanatory. The study moved from a comprehensive analysis of LCI as a social practice to an explanation of its management in complex subjects oriented toward DL.
6. Method (design): systematization of experiences. This method favored the analysis of knowledge, based on systematized practices and professional experiences, presented by the participants, and revealed how to manage LCI in ADL.
7. Main information collection techniques: an online survey was administered to seven experts, and the responses were automatically recorded in a Microsoft Excel template stored in Google Drive. In addition, the focus group technique was applied to 42 graduate students (separately to 20 from a graduate course and 22 students from a master's program), and the responses were manually recorded on paper.
   7.1. Procedure for analyzing information and determining results: coding and content analysis techniques were used. The information was analyzed using coding and data saturation procedures.
8. Theoretical methods: analysis-synthesis, inductive-deductive, and generalization-abstraction.

9. Sample: 49 subjects. Non-probability convenience sampling was used. Participants: seven experts (six PhDs in specific sciences and one Master of Science; three full professors, two assistant professors, and two teaching assistants from six institutions in four provinces of the country, with an average of 26.9 years of professional experience) who responded to the online survey. Also participating were 20 professionals enrolled in the postgraduate course "*Management of scientific-research leadership in local development actors*" (including six doctors and postgraduate or master's specialists) with experience in process management and social process leadership; as well as 22 psychologists enrolled in the master's degree program *"Psychosocial Intervention in Human Development"* (all of whom manage socio-educational processes).
   9.1. Ethical aspects: participation was based on principles of confidentiality, anonymity, and voluntariness. (Recognized by the institution overseeing the research).
10. Main study category (unit of analysis): LCI management (essential aspect), analyzed from the contextual perspective of ADLs. This is the category that is understood and explained in terms of proposing guidelines for its enhancement. Three leading questions were posed to gather information (in both techniques [online survey and focus group]): (1) What personal qualities do you think should characterize a scientific-research leader? (2) What criteria or indicators are key to identifying a scientific-research leader? (3) How can scientific-research leadership be managed comprehensively and effectively in key actors for local development? (Proposed guidelines, steps, actions, procedures, keys, etc.).

## RESULTS AND DISCUSSION

The results are organized in the order of the guiding questions asked.

**(1) What personal qualities do you think should characterize a scientific-research leader?**

The expert survey identified six essential qualities recognized as most relevant in a scientific-research leader: **teamwork**, **ethics**, **proactivity, creativity**, **mobilizing agent**, and **communication capacity**. These qualities were also recognized in the focus groups.

In the focus group with graduate students, the importance of teamwork and research competencies as essential aspects was emphasized. Participants argued that leadership only makes sense when interpersonal influences around a common goal are appreciated. "It is not enough to have charisma

and the will to motivate others; the scientific-research leader must be an example of a science manager."

For their part, the focus group of master's degree psychologists emphasized teamwork and proactivity. The psychologists insisted on the active role of the subjects. The conscious nature of leadership and the responsibility that this implies was discussed. Leaders of scientific processes combine aspects of formal and informal leadership: the content of their influence is related to formal processes that are important for institutional functioning and effectiveness; however, the leader's influence is made effective and lasting through informal content.

The debate generated in both groups led to the emergence of other categories to qualify scientific-research leaders: charisma, decision-making capacity, mobilizing agent, and future projection. Analysis of these categories allowed them to be understood as characteristics of leaders, inherent in the six essential qualities mentioned above; that is, they are qualities that are expressed while the leader develops teamwork, is proactive, creative, or a mobilizing agent.

The six essential qualities should characterize scientific-research leaders, but their mere presence in a subject does not necessarily imply that they will develop this type of leadership. They are essential personality traits; however, the identification of the scientific-research leader entails the presence of criteria or indicators specific to the nature of scientific-research activity.

The six essential personal qualities of the scientific-research leader identified in the study are generic in nature; they are not specific and exclusive to the LCI, but their absence would pose a significant difficulty in exercising the role. Scientific and research work requires interdisciplinarity and collaboration among colleagues, which is why the quality of teamwork skills is vital.

Several studies argue the value of this competence. For example, Piña Borrego (2022) argues that the scientific-research leader is associated with teamwork, requires leading the efforts of people within a project, and rarely works alone.

These references support the findings of the study. It is valid to understand that the exercise of leadership involves interaction with other individuals, as it is a social (relational) process; but it is also necessary to assume its conscious nature, which transcends the interactive and gives it the status of work: the leader works in a team.

Similarly, ethical quality, regularly expressed in performance, is a guiding aspect of LCI. This characteristic is recognized by scholars such as Cuba Jiménez and Escribano Hervis (2023), who defend ethics and responsibility as keys to researcher performance, as values that are shared in research organizations and contexts.

Ethics is a key aspect of the scientific leader's performance when dealing with scientific information and references. Leading in the sciences involves critical analysis, judgment, and a certain level of distance from previous studies. These actions require ethical behavior expressed in a conscious attitude of respectful scientific irreverence (Deroncele Acosta et al., 2021).

Likewise, the development of activities related to the LCI requires proactivity as an important quality that has been recognized in several studies. Deroncele Acosta et al. (2021) point to proactivity (epistemic, in this case) as a positive attitude that allows researchers to process scientific information and achieve satisfactory results.

Proactivity refers to a quality of activism in leaders to act in a self-aware, self-regulating, and active manner, based on personal values and not as a result of social pressures. Being proactive means knowing what to do and doing it; it involves making informed decisions based on values. This quality is key; its development geared toward organizational interests can condition a close relationship between personal aspirations and organizational goals.

Creativity responds to the innovative orientation of individuals. This quality is closely related to the capacity to innovate, to design and create something essentially new. It refers to knowledge and skills used to make innovations that respond to emerging problems, typical of complex systems, based on interdisciplinary research and a willingness to disrupt. Furthermore, this quality is essential for achieving scientific novelty in research through dialogue between the conventional and the novel (Deroncele Acosta et al., 2022).

In a similar vein, González Rey and Mitjáns Martínez (2021) recognize creativity as a fundamental element in producing novel theoretical constructs during research. They consider that, by being creative, the researcher assumes the role of subject in the research process, becomes passionate, and is capable of generating novel ideas to respond to research problems.

These postulates support the identification of creativity as a key quality for LCI. Thus, its importance and the need to identify and enhance it as a premise during LCI management are recognized.

The qualities of mobilizing agent and communication capacity are fully recognized in the academic community as inherent qualities of a leader. These characteristics are closely related and are expressed as competencies to influence others, inspire them, motivate them, etc. In this sense, Piña Borrego (2022) argues that scientific leaders must bring together and mobilize professionals with research potential to improve scientific performance and productivity.

The communication capacity of scientific leaders are expressed in interpersonal relationships, but they transcend this and encompass different forms and channels of scientific communication and dissemination. They require knowledge and skills about what, how, and where to disseminate science. The nature of the LCI allows leaders to influence people and communities both personally and directly, as well as indirectly and through intermediaries. Therefore, mastery of mass communication tools (to address large and extensive audiences), scientific-textual construction, and scientific publication management is key for the LCI.

**(2) What criteria or indicators are key to identifying a scientific-research leader?**

The experts listed indicators related to the superior research performance of professionals. They emphasized **research competence** as a synthesis of skills, abilities, knowledge, values, attitudes, and motivations related to science. There is agreement on the recognition of leaders based on their participation in research groups and projects and academic networks, as well as their scientific development expressed in concrete scientific results at the local, sectoral, national, or international level.

They also argue that a leader is recognized in the academic community for the socialization of results and digital identity (both aspects require competencies in information and communication technologies). They also point out that a scientific-research leader can be identified by their ability to lead with a democratic style, to manage finances and processes, to distribute tasks and responsibilities, as well as administrative skills and the development of critical and innovative thinking.

In the focus group discussions, the professionals agreed on the theoretical reference points that were reviewed in relation to the indicators for identifying scientific leaders. Assessments were made regarding the dynamic nature of scientific contexts and practices: this requires constant updating of the LCI indicators. However, participants weighed up scientometric indicators (measures of scientific output), altmetric indicators (alternative metrics related to impact on the scientific community), digital identity, and scientific competence and activism.

Scientific-research leaders are understood from contextual (by level: from local to international) and relational perspectives, based on the influence of some subjects on others in scientific activity. **Scientific activism,** expressed in high scientific-research performance (project management, publication of results, etc.) and a notable impact on the academic community (followers of their work, h-index, and index of interest in databases), is based on Information and Communication Technology (ICT) competencies and enriched by the leader's digital identity.

In summary, three key indicators are determined to identify the LCI:

1. research knowledge and competence
2. scientific activism
3. digital identity and ICT competencies

These indicators encompass other less integrative qualities and are closely related to each other.

**knowledge and research competence** highlights what a professional is capable of doing when faced with the object of research: defining it, delimiting it, establishing its epistemic matrix, diagnosing its expression in key contexts, and transforming it, either to correct limitations or to enhance its strengths. Many authors agree that this is one of the keys to LCI. Piña Borrego (2022) highlights wisdom, values, and ideology as essential factors for objectively analyzing data, applying logic, and substantiating conclusions in scientific research.

Similarly, Simoes and Crespo (2020) establish a direct association between leadership and knowledge, arguing that the most important roles associated with scientific leadership are those related to the formulation of the theoretical design of the research, the review of the literature to substantiate the research, the methodological design, and the supervision of the project. This position coincides with and reinforces the findings of the present study. Furthermore, it applies to ADLs if the

corresponding level of contextualization is considered. ADLs do not strictly require high levels of research expertise and extraordinary knowledge to project themselves as LCI; their status as leaders requires knowledge and skills that are relatively superior to the "average" in their context.

In summary, LCI can be identified and further enhanced in ADLs who are distinguished by their scientific and professional knowledge, as well as research skills superior to those of other actors.

**Scientific activism** has also been recognized by other authors such as Hirsch (2019, cited in Simoes & Crespo, 2020), Simoes and Crespo (2020), Ortiz Torres and Viamonte Garrido (2021), and Piña Borrego (2022). The publications of these researchers highlight the identification of scientometric indicators and other alternative metrics as qualities of leaders.

This knowledge supports the research results and indicates that they constitute a key route for the identification and training of the LCI. Sciometric indicators such as the number of publications, the impact factors of the journals in which they publish, the number of citations, the funding received to conduct research, among others, are evidence of activism and clearly point to the presence of LCI (Piña Borrego, 2022).

Hirsch's conclusions (2019, cited in Simoes & Crespo, 2020) regarding the h and há indices also support the results of this study; that author asserts that a high há/h ratio is a hallmark of scientific leadership. This means that it is not just a matter of achieving a high h-index, but of playing a leading role among the other co-authors of published works; the há-index is an attempt to overcome the limitations of the h-index.

For their part, Simoes and Crespo (2020) consider that scientific leadership should be more closely linked to each author's topic of study and propose a new metric to identify it: counting each author's contribution to the research carried out, based on the number of self-citations: the author with the most self-citations has been more active, contributed more, and shown greater leadership in obtaining a result. This reinforces the position of Ortiz Torres and Viamonte Garrido (2021) regarding the inverse index of solo citations: "the number and percentage of solo authorships will be inversely proportional to teamwork."

Now, when these indicators are contextualized to ADLs, which are not always prolific in terms of scientific publications, it is necessary to identify other expressions of activism. Being a leader does

not mean being above others; it means being one step ahead. In this sense, it is recognized that activism can also be seen in actions such as: participating in science and technology forums, conferences, conventions, or other scientific activities; participating or collaborating in research, advising studies, tutoring, or advising students' practices or research.

ADLs demonstrate their activism when they create spaces for innovation, creation, exchange, scientific discussion, or training; when they actively participate in knowledge management.

In contemporary times, characterized by the digitization of social processes, scientific activism is closely linked to **digital identity and ICT competencies**. Activism acts as both a cause and a consequence of the digital identity constructed by the researcher and their ICT competencies, with an emphasis on those related to networking and the use of generative artificial intelligence.

Digital identity and ICT competencies have been recognized in various studies as fundamental elements for LCI. Vargas Pinedo et al. (2022) recognize that LCI training includes ICT management and the development of digital competence. Aguilar Herrera (2023) concludes that academic networks act as spaces that contribute to the training of researchers. This occurs through the leadership of researchers within the framework of the relationships established in these spaces. Such leadership is recognized based on the digital identity constructed and displayed in digital networks.

The contextualized analysis of the results of this study confirms digital identity as a clear indicator of LCI: ADLs who have created a notable digital footprint will be recognized as leaders, so that they can be viewed and followed by other actors. The creation of digital identity can be achieved through actions, some general and others more specific:

General: creation and updating of the entity's websites; creation and curation of profiles on social networks (Facebook, Instagram, X, LinkedIn, etc.); provision of courses and training to the entity's employees so that they can communicate effectively in the digital sphere; offering recognition and incentives for best practices in favor of digital identity.

Specific: creating and curating profiles on academic social networks, such as Researchgate, ORCID, Google Scholar, Adacemia.edu, among others; disseminating articles published in journals on social networks and institutional repositories; disseminate academic results and articles published in

journals on LinkedIn; publish research results in journals indexed in high-impact and high-visibility databases (Scopus, Web of Science, SciELO), mainly.

To carry out these actions, mastery of ICT is essential. Therefore, the results revealed in the research are consistent with international policies and trends regarding ICT development and the formation of digital identity.

**(3) How can scientific and research leadership among key actors for local development be managed in a comprehensive and effective manner? (Proposal of guidelines, steps, actions, procedures, key points, etc.)**

Analysis of the experts' responses revealed that there are essential aspects to LCI management: determining key areas of development; identifying the limitations and potential of the context; determination of actors, leaders (individual and group) and the schedule of actions for development; promotion of scientific-research activity; capacity building for scientific management and leadership attitude; promotion of the active participation of researchers in the solution of organizational situations.

For its part, the focus group technique in the two postgraduate groups made it possible to identify keys to LCI management. The need to institutionalize the scientific leadership management process (which should not be conceived as a spontaneous process) was recognized. It was proposed to identify individuals with attitudes conducive to LCI and to stimulate them as part of policies designed for the strategic management of the organization in which the process is managed; for example, in a state-owned enterprise, a medium-sized private company, or a cooperative. The need to foster the emotional involvement of leaders through their motivation and mobilization by providing support, resources, recognition, and performance evaluation was highlighted.

The synthesis of these ideas allows to determine the following methodological guidelines for LCI management in organizations:

- Institutionalize the LCI management process in organizations involved in DL.
- Determine the key areas of science management for development (integrating the local and organizational levels).

- Conduct a diagnosis of the context (the organization and its environment) with an emphasis on strengths and opportunities.
- Identify individuals with the qualities to exercise scientific and research leadership (individuals, research groups, departments, areas).
- Establish the institutional work system and work plans and/or results of the identified leaders, based on the achievement of organizational goals.
- Establish an organizational training and capacity-building system based on the qualities and indicators for the LCI. (This may include psycho-organizational intervention).
- Establish a system for stimulating and monitoring LCI at the organizational level.

Discussion of the proposed guidelines is key to understanding their theoretical and practical meaning. In this order, this paper proceeds to analyze each guideline in relation to the scientific content that allows for arguing its existence and expression.

***Institutionalize the LCI management process in DL organizations***

The institutionalization of LCI management is key to preventing such an important process from being left to the goodwill of managers or the interest of isolated individuals. The debate generated in the focus groups and the emerging idea of creating a regulatory framework in entities to manage LCI are consistent with positions taken by other researchers.

In principle, the interaction in the focus groups defended the importance of integrating LCI into organizational functioning and, consequently, aligning organizational efforts with DL objectives. All of which implies the conscious, formal, and planned nature of LCI management. This position is in line with the idea of Díaz-Canel Bermúdez et al. (2020), who state that the management of science and innovation must be aligned with DL strategies and government policies in order to increase its impact.

In a similar vein, Zamora Rodríguez et al. (2024) consider that the management of institutions must show interest, commitment, and willingness to implement the corresponding actions. The process is legalized through the intervention of management as the responsible entity and through actions such as updating scientific reserve resolutions and continuing education processes to strengthen the institutional framework.

Another example that corroborates the value of this guideline is the proposal by Piña Borrego (2022) regarding the organization of regulatory frameworks to guarantee aspects of scientific policy, personnel, infrastructure, equipment, etc. Piña-Borrego recognizes the fundamental nature of regulating the process in all its components.

The first guideline should be to institutionalize the course of subsequent guidelines. This can be done through institutions of varying sizes, depending on the characteristics of the organization. As hypothetical examples, the regulatory institutions for LCI management could be circular letters, instructions, regulations, guidelines, among other forms of binding regulations.

***Identifying key areas of science management for development***

Simoes and Crespo (2020) argue that LCI responds to topics or areas of knowledge: leadership is exercised around an area of knowledge. In this sense, ADLs need to consciously determine the area in which they can exercise and develop their leadership.

This guideline refers to aspects that are defined by organizational policy, such as those that may be priorities for the work. They refer to key result areas, strategic objectives or processes, prioritized sectors, strategic axes, etc., but they must always be reconciled and all those involved must be aware of them. Each individual or organizational subject needs to define the area in which, according to their potential, they can enhance leadership to achieve higher levels of development.

The key area of science management must, of course, respond to the development priorities conceived at the municipal level, specifically, with strategic lines of development, conceived in the Municipal Development Strategy. The determination of priority areas for science and innovation management has become an increasingly necessary and common practice; for example, the study by Tronina et al. (Tronina et al., 2020) proposes a methodological tool for selecting territorial development priorities, based on the concept of *smart specialization.* Similarly, the study published by Zamora Rodríguez et al. (2024, p. 4) also refers to "priority lines of research for the institution."

These publications demonstrate the importance of this guideline and confirm its necessity in the conception of LCI management.

***Conducting a diagnosis of the context (the organization and its environment), with an emphasis on strengths and opportunities***

This guideline refers to a detailed analysis of all the conditions that favor or limit the subject's development, with an emphasis on those with positive connotations. The approach prioritizes the positive core given in the subject's strengths, opportunities, interests, aspirations, desires, and actualizing tendency (Gross Tur et al., 2020).

This guideline focuses on the description, characterization, and diagnosis of the positive aspects or core elements that are most useful or conducive to promoting LCI. ADLs need to determine their main potentialities and resources to stimulate the development of LCI around the key area or areas defined above. This guideline highlights the conscious nature of leadership management: each actor determines the prioritized key area and diagnoses the conditions they have to enhance it: they determine the department, the process, the means, the collaborating institutions, or any other aspect that favors LCI management.

Zamora Rodríguez et al. (2024) point out that it is necessary to analyze the context in terms of the factors (political, economic, legal, social, educational, environmental, technological, or cultural) that may influence the achievement of the expected scientific and research results.

In short, this guideline is consistent with the logic that moves from diagnosis to intervention actions; therefore, it is very appropriate to diagnose the conditions surrounding any process in order to achieve the best possible results.

***Identify subjects with qualities to exercise LCI (individuals, research groups, departments, areas)***

Identifying subjects is essential: the essence of LCI management lies in promoting essential qualities and key indicators. This guideline is consistent with steps or actions outlined in studies addressing similar issues.

Zamora Rodríguez et al. (2024) propose selecting talented students to work and train around defined lines of research; identifying internal and external facilitators; and determining the specialists with

the best professional, ethical, and moral conditions to contribute to leadership management. In both cases, the selection is oriented toward subjects with the potential to develop LCI.

This guideline is fundamental. Although departments, groups, or organizations may become leaders, it is necessary to be aware that this process is actualized in the concrete actions of individual subjects. Therefore, LCI management requires that those responsible for institutions act consciously to select individuals with the potential, desire, and ethical and moral conditions to project themselves as leaders.

***Establish the institutional management system and work plans for identified leaders, based on the achievement of organizational goals***

This guideline highlights the conscious and planned nature of the LCI management process. It specifies the activities to be carried out both by the institution, in an organizational sense, and by the individuals involved, in a personal sense. It can be organized through an institutional schedule, specifying the objectives to be achieved, the actions, the resources (including financing), etc., and the individual work plans.

This type of organizational practice is common for these types of work. The managers of these processes usually plan and coordinate actions that contribute to their objectives. For example, in a recent study published by Zamora Rodríguez et al. (2024), reference is made to a schedule of actions as a way to promote scientific culture.

In short, this guideline contributes to the organization, planning, and conscious coordination of personal and institutional efforts and actions in favor of the common goal. It takes the form of instruments that express the alignment of organizational functioning with LCI management and the strategic lines of the DL. It responds to the problem of science and innovation management in Cuba (Díaz-Canel Bermúdez et al., 2020).

***Establish an organizational training and capacity-building system based on the qualities and indicators of the LCI***

Within the LCI organizational management system, education and training are understood as two interrelated processes. LCI management in the ADLs necessarily involves training individuals in the

key qualities required to perform as leaders and the indicators that essentially result from the exercise of LCI.

Training and capacity building are essential steps in LCI management. This guideline is consistent with the idea of highlighting the role of training as an essential aspect of the management of science, knowledge, and innovation.

For example, Vargas Pinedo et al. (2022, p. 1154) argue that in order to promote "the management of emotions in and for research," teachers and must be trained and educated emotionally through interactive workshops, programs, or other forms of training processes. Similarly, Zamora Rodríguez et al. (2024) advocate for the "Scientific Accelerator for Young Talent in Cuba" program, which is based on the premise of training young people through various channels: participation in projects, scientific dissertations, doctoral scholarships, scientific societies, among others.

Actions such as mentoring or coaching can also be included as part of the LCI training process: some individuals with greater leadership skills can support the development of others with leadership potential.

In summary, LCI management involves training individuals in the qualities and indicators that define this type of leadership and the mission of their DL organization.

***Establish a system for monitoring and stimulating LCI at the organizational level***

This guideline contributes to closing the LCI management cycle, but it does not only occur at the end of the process; on the contrary, it is constantly evolving. The establishment of the control system consists of monitoring compliance with the actions planned in accordance with the development of the LCI and the achievement of the objectives of the organizations involved in the DL.

The control process must be carried out by a responsible person within the organization, although it may be supported by external organizations with the necessary skills to evaluate, point out, correct, guide, and reorient the LCI management process. It must be conceived with all its importance in order to give meaning to the work generated from the other guidelines. Establishing the control system contributes to a better environment for leadership management and gives it greater institutionality.

The stimulation of this process is also based on the motivational logic of rewards and prizes. While the program "Scientific Accelerator of Young Talent in Cuba" emphasizes the need to stimulate the development of human potential (Zamora Rodríguez et al., 2024), the work published by Gross Tur et al. (2020) argues that the management of training potential includes the stimulation of the positive core of the subjects. Both positions support the idea of intrinsic stimulation as a key guideline in LCI management; however, this study proposes the integration of extrinsic and intrinsic stimuli to promote leadership development.

Intrinsic stimulation refers to the generation of motivation from the practice of leadership itself, as also described in the actions proposed by Cuba Jiménez, and Escribano Hervis (2023). However, the integration of extrinsic motivation, consisting of the implementation of recognition policies, emulation systems, the establishment of awards, the dissemination of results, among other initiatives, can encourage LCI. In this way, negative manifestations related to the support of individuals with scientific leadership potential can be counteracted (Piña Borrego, 2022).

In summary, the guidelines determined are consistent with scientific arguments shared in the scientific community. They have the potential to contribute significantly to science- and innovation-based government management once they are consciously implemented in organizations involved in DL. The study has the limitation of not having empirical verification of the guidelines; however, the methodology applied, which weighs the knowledge, expertise, and experience of the participants, recognizes the validity of the results. In addition, the study guides the topic toward a deeper understanding of the differential development of LCI according to the particularities of the different types of ADL.

The research has identified six essential qualities recognized as most relevant in a scientific-research leader: teamwork, ethics, proactivity, creativity, being a mobilizing agent, and possessing communication skills. While these qualities are not sufficient on their own to identify LCI, they are fundamental prerequisites for the exercise of leadership.

Three key indicators are determined to identify the LCI: 1) research knowledge and competence, 2) scientific activism, and 3) digital identity and ICT competencies. The integration of these indicators expresses the LCI by revealing its essence and nature.

Seven guidelines for LCI management in ADLs have been identified. These guidelines are interrelated and designed to cover the entire management process, from its institutionalization to its completion, in a constant process of control and stimulation, including the identification of key areas of organizational development, the diagnosis of the context with an emphasis on positive aspects, the identification of individuals with the greatest potential to act as leaders, and their education and training, in addition to the establishment of an organizational management system and work plans and results consistent with the LCI.

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**Conflict of interest**

Authors declare that they have no conflicts of interest.

**Authors' contribution**

*Ramiro Gross Tur* conceived and designed the study.

*Ramiro Gross Tur, Oscar Hechavarría Prade, and Lilian Suárez Cid* participated in the data collection, analysis, and interpretation, as well as in writing the manuscript.

*Lilian Suárez Cid and Angel Deroncele Acosta* participated in the critical review of the article, making significant contributions to its intellectual content.

*Angel Deroncele Acosta* contributed to the conception and design of the study.

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