

Outcome evidencing report on the Local Technical Agroclimatic Committees in Colombia

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Executive Summary

In the past decade, there has been a growing focus on customizing climate information to meet the needs of users through continuous consultation among stakeholders across the climate service value chain, which includes the production, translation, dissemination, and utilization of climate data. Local Technical Agroclimatic Committees have emerged as an innovative solution to involve local stakeholders in the creation, interpretation, distribution, and application of information on anticipated climatic events and their potential impact on agriculture and other sectors.

Since their inception in 2014, 27 MTAs have been established in Colombia, with the support of the Ministry of Agriculture and institutions such as the Food and Agriculture Organization and the Alliance of Bioversity International and the International Centre for Tropical Agriculture (CIAT).

This report presents an outcome evaluation focusing on Local technical Agroclimatic Committees (Mesas Técnicas Agroclimáticas - MTA hereafter) in Colombia. The evaluation relies on asystemic evaluation approach, focusing on the diversity of actors, their roles, and the changes experienced through participation in the MTAs.

The study covers five MTAs that have seen the most significant changes, as identified by MTA representatives and validated by key actors through semi-structured interviews. Outcomes are defined as changes in practices, behaviors, and interactions, with the aim of assessing the trajectory of the MTAs and the enabling or hindering factors in their implementation.

A total of 17 interviews were conducted involving informants from MTA-participating institutions in the regions of Cauca, Córdoba, Sucre, Risaralda, and MCGA.

The results show that the MTAs in Colombia are defined as collaborative platforms where various actors exchange climate information to improve agricultural decision-making, livestock management, and risk reduction. These spaces aim to reduce climate risks through forecasting and provide actionable recommendations for sectors like agriculture and livestock but also beyond.

Since their establishment, MTAs have evolved, expanding from local municipalities to larger regions and diversifying the actors involved. The focus has shifted from basic climate information to specialized recommendations on territorial risk management and environmental concerns. Participants in the MTAs include government bodies, universities, producer organizations, research institutions, extension services and risk management bodies. They have seen increased participation from diverse sectors, reflecting growing interest in climate information.

Respondents identified key outcomes from the MTAs, highlighting significant shifts in behavior, practices, and interactions. Among these, 8 changes in behavior (e.g., improved strategic

planning), 4 changes in practices (e.g., adaptive agricultural practices), and 6 changes in interactions (e.g., increased collaboration) were noted.

In Cauca, coffee growers adopted better agricultural planning and adaptive practices through timely climate information, with significant support from the Coffee Federation. Córdoba rice producers benefited from tailored climate data and advice, which improved their agricultural practices despite limited resources. In Sucre, rice farmers improved harvest planning by adopting MTA recommendations, while women farmers embraced environmental conservation practices, reducing costs and receiving recognition for their contributions. In Risaralda, MTA forecasts helped reduce fire-related calls by 70% and improved collaboration among fire brigades and local actors. Similarly, the MCGA region enhanced collaboration between environmental and agricultural sectors, fostering climate literacy and informed decision-making among producers. Decentralized information sharing and the establishment of a technical secretariat strengthened the MTA's structure, enabling more effective climate risk management.

Despite these successes, challenges persist, such as the limited participation of certain actors and barriers to adoption in specific agricultural sectors. Women's participation has increased, particularly in regions where female leadership is prominent, but ethnic minorities are still underrepresented. There is also a need for better evaluation of how farmers adopt MTA recommendations.

Despite these challenges, the MTAs have made significant progress in regional agroclimatic planning. To strengthen their impact, improving monitoring, securing funding, and providing administrative support are key steps to ensure the MTAs continue to adapt to local needs and remain effective in climate and agricultural planning.

In conclusion, the Local Technical Agroclimatic Committees (MTAs) in Colombia play a crucial role in fostering collaboration and climate information analysis, creating targeted recommendations for improving agricultural practices and risk management. These platforms have evolved to meet the diverse needs of different regions, shifting from producer-centric models to broader territorial risk management.

They have been instrumental in particular in promoting better strategic planning, not only in agriculture, and encouraging cross-sector collaboration. However, challenges remain, including minority inclusion (due to language, cultural, and geographic barriers), insufficient monitoring and evaluation of the uptake of recommendations by farmers, and institutional dynamics that disrupt continuity.

1. Introduction

In the past decade, significant attention has been paid to tailoring climate information to users' needs through regular and iterative consultation between the different actors along the climate service value chain, i.e. the production, translation, dissemination and use of climate information. Local Technical Agroclimatic Committee (MTA) have been deployed as an innovative approach to engage local stakeholders in producing, translating, disseminating and using information about expected climatic variations in specific areas, and how they can affect the agricultural sector (and beyond). The MTA is a dialogue process among a diversity of local actors including scientists, technicians, representatives from the public and private sectors, and farmers, which seeks to understand the climate's possible behavior in a locality, and to generate recommendations to reduce risks associated with expected climate variability (Loboguerrero et al., 2018). This dialogue seeks to understand, predict, and respond to possible climate behavior in any specific locality and to generate local specific recommendations to reduce risks associated with expected climate variability (Giraldo Mendez et al., 2019). The output from this process is a local agroclimatic bulletin based on the seasonal climate forecast for the region, with the possible impacts on crops for specific conditions, as well as recommendations for agricultural production planning and decision making.

Additionally, MTAs build social capital within the agricultural system, potentially improving resilience and long-term outcomes (Martinez-Baron et al., 2018). The adaptive and networked nature of MTAs in Latin America has notably enhanced the region's socio-ecological resilience, as they respond to local needs and incorporate local perspectives.

By connecting individuals and communities with institutions in a participatory way, MTAs can contribute to empower local stakeholders and ensure that previously marginalized voices are heard (Läderach et al., 2023). As an example, in Senegal, empowerment of diverse stakeholders has been identified as a key transformation area linked to the MTA approach to provide climate and weather services, from women farmers engaged in MTAs taking up leadership roles in their country to journalists becoming recognized experts on climate related issues (Blundo-Canto et al., 2021).

Collaboration underpins co-production and related "co-" terms (co-exploration, co-design etc.) that refer to the importance of the process as an end in itself, as opposed to a means to an end. Collaboration is at the very heart of co-produced climate services, which require the building of relationships and partnerships between producers and users throughout the cycle (Vincent et al. 2018). Findings indicate that MWGs are positively associated with farmers' awareness, access and uptake of WCI resulting in farm management responses depending on the type of information used. This suggests that participatory approaches in the provision of tailored climate information and advisory services can lead to higher uptake and use

among farmers in informing farm management responses for better adaptation to climate change (Chiputwa et al., 2022).

To date, the few existing evaluations of the impacts of MTAs usually focus on single-effect (e.g. yields or income) and single-user (farmers) impacts of using information they generate and disseminate through agroclimatic bulletins and other transmission channels (Chiputwa et al., 2022; Vaughan et al., 2019). However, MTAs are an innovation engaging multiple actors in producing, translating, disseminating, and using climate information, which has the potential to generate systemic outcomes from the meso (local stakeholders) to the macro (national stakeholders) level (Blundo-Canto et al., 2021; Giraldo Mendez et al., 2020).

The outcome evaluation herewith presented focuses on the case study of the MTAs and Agro-Climatic-Bulletin (hereafter the Bulletin) in Colombia. In Colombia, the approach is identified as the Mesas Técnicas Agroclimáticas approach. Throughout the document, we refer to the whole process as the MTAs.

1.1. The Local Technical Agroclimatic Committees in Colombia

According to Loboguerrero et al. (2018), MTAs were first developed in Colombia in 2013 as a result of a set of enabling conditions.

In 2013, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and the non-governmental organization (NGO) Fundación EcoHabitats worked together to establish the so called Climate Smart Village (CSV) in the department of Cauca.

Simultaneously, the Procuencia Río Piedras Foundation and the local water company, Acueducto y Alcantarillado de Popayán S.A. E.S.P., were developing a climate variability warning system for small farmers and indigenous communities. This system aimed to provide better information on the impact of climate change on livelihoods. To achieve this, both foundations collaborated with the CCAFS program to receive information from the Climate Smart Agriculture Prioritization Framework, allowing them to offer agro-climatic recommendations in addition to climate forecasts to help adapt agricultural production systems.

Around the same time, the Colombian government, through the Ministry of Agriculture and Rural Development (MADR), partnered with the CCAFS program and the (then) International Center for Tropical Agriculture (CIAT) to launch a joint project aimed at mitigating the effects of climate change and climate variability in Colombia. The project included the development of an experience exchange program based on CSV initiatives in Colombia and Senegal.

In Senegal, the CCAFS program had been implementing a strategy to improve access to and capacity building for understanding and using agro-climatic information. This strategy involved bringing together weather forecasts from scientists and the traditional knowledge of local communities. It aimed to help farmers understand and use seasonal forecasts for better crop strategies while enabling farmers to communicate their climate information needs to meteorologists (Howland, 2017). Members of IDEAM, FENALCE, FEDEARROZ, and Universidad Nacional also participated in this exchange.

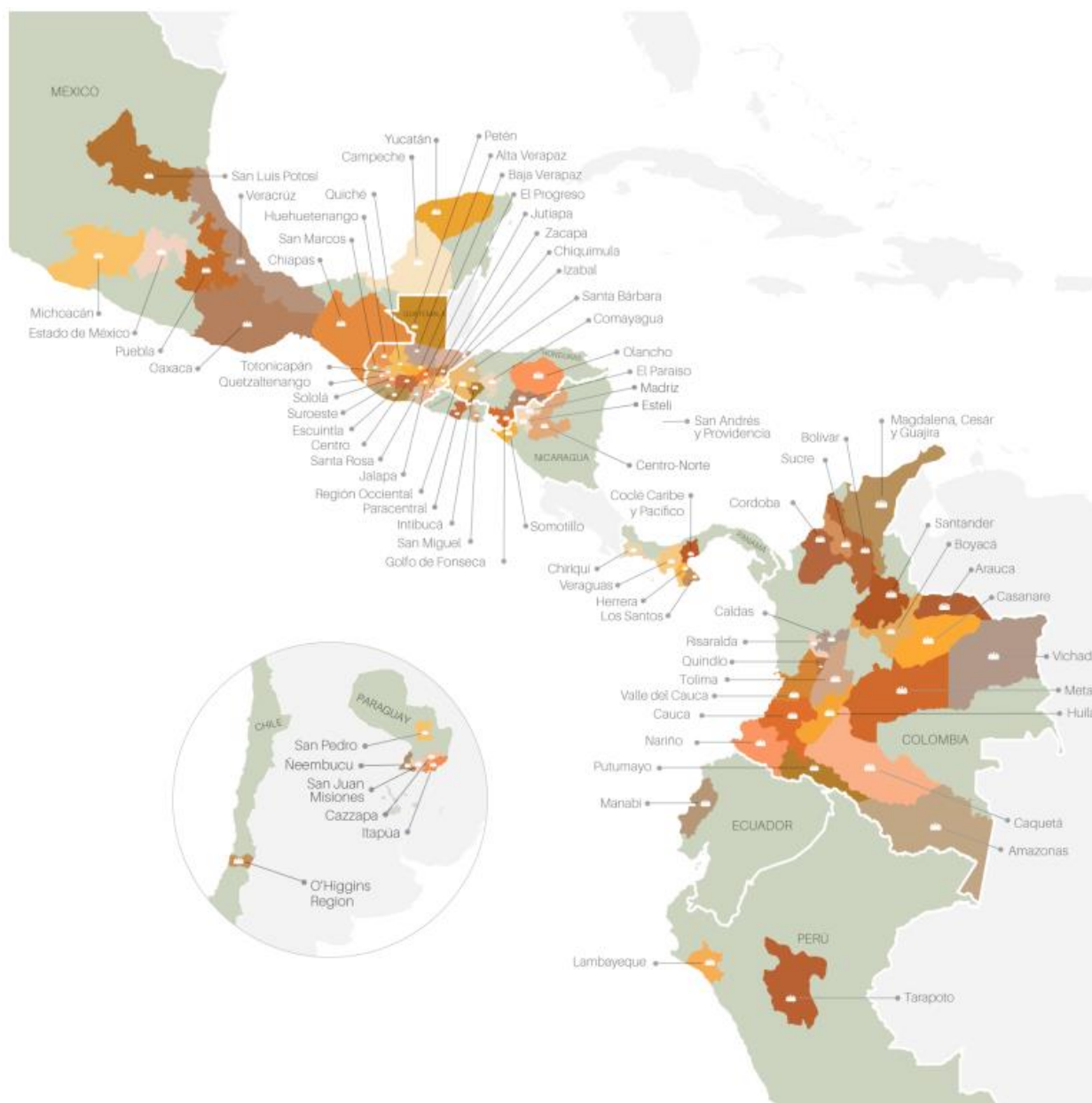
Following the exchange of experiences, the CCAFS program held a meeting with representatives from the participating organizations, where they agreed on the importance of supporting the creation of MTAs in Colombia. As a result, leveraging the experience of the CCAFS program and the work of the Procuencia Río Piedras Foundation in Cauca, it was decided to establish an MTA in the department. Additionally, with the involvement of FENALCE and FEDEARROZ, an MTA was developed in the department of Córdoba, where both federations took action (Loboguerrero et al., 2018).

Two agencies that participated in the initial meeting were key. The first was the Municipal Agricultural Technical Assistance Units (UMATAs), which in Colombia are responsible for providing technical assistance to small and medium producers to improve their livelihoods. UMATAs were tasked with disseminating the recommendations generated after the meeting and gathering feedback on farmers' performance. The second agency was IDEAM, which played a crucial role by providing real-time meteorological information and accurate weather forecasts tailored to local conditions.

Loboguerrero et al. (ibid) also notes that IDEAM raised a critical point for the development of MTAs: the need for resources. Due to resource constraints, IDEAM was unable to consistently provide climate information or participate regularly in the MTA meetings in Cauca and Córdoba. Much of the success of the MTA in Colombia can be attributed to the governmental support, which included legal recognition and the resources secured through this support.

At present, Figure 1 represents the distribution of MTAs throughout Latin America at present. To date, MTAs have been implemented in 11 countries in the region (Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Panama, Colombia, Ecuador, Peru, Chile, Paraguay) for a total of 70 MTAs in Latin America (Rios et al., 2023).

Figure 1. Distribution of MTAs in Latin America



Source: (Ríos et al., 2023)

The Colombian government, through the MADR, developed the Agronet website where information and communication for the Colombian agricultural sector is compiled and where agro-climatic bulletins generated by the MTAs led by IDEAM and MADR are compiled¹.

One of the successes for which the Colombian case is recognized is the sustainability of the MTA initiatives in terms of resources. The participation from the beginning of the MADR was a

¹ To access all the agroclimatic bulletins generated by the MTAs, please consult the following link: <https://www.agronet.gov.co/agroclima/Paginas/DocumentosTecnicos.aspx>

key point for the investment of public resources in the creation and sustainability of the MTAs in multiple regions of the Colombia. Since 2019, another key actor, the Food and Agriculture Organization (FAO) of the United Nations has enabled the revitalisation and continuity of the MTAs in Colombia.

Since their inception, in 2014, 27 MTA have been established in Colombia.

2. Methods

2.1. Evaluation approach

This outcome evaluation adapts the complexity-aware and systemic evaluation approach applied in Blundo Canto et al (2021) that examines the diversity of actors, interests, and roles, and changes they experience by engaging in the MTAs, as well as the contextual factors that enabled these changes in the Colombian case study. The study focuses on 5 MTAs that have developed most significant changes according to the MTA representatives, validated by key actors engaged in each of these MTA.

The evaluation approach relies on two components:

- a) Reconstruction of the history/trajectory of the innovation (Douthwaite and Ashby, 2005; Faure et al., 2020);
- b) Evaluation of the outcomes of the MTAs by substantiating outcome identified by MTA coordinators, borrowing tools from Outcome Harvesting (Wilson-Grau, 2018) and Outcome Evidencing (Paz-Ybarnegaray and Douthwaite, 2017)

We define outcomes as changes in practices (systematic shifts in what people do), behavior (systematic shifts in how people do things, take decisions, strategize, plan), and interactions (systematic shifts in how people interact, collaborate, engage with each other, or new relationships, collaborations and partnerships).

The focus of the evaluation is the identification of outcomes by MTA coordinators and their validation by interviewing actors engaged in the MTAs.

The outcome statements validated with key stakeholders included:

- The outcome: who is doing the change, since when, how is this different from what they were doing before
- The significance of the outcome: why is this change important
- The contribution of the intervention (the MTA): how did the MTA existence or implementation contribute to generate this change
- The contribution of other factors or actors: how did other factors and actors contribute to generate this change

The data through which the outcome statements were formulated relied on:

1. A documentary review on the MTA approach in Colombia

2. An outcome identification workshop with all MTA representatives in Colombia to identify the main outcomes achieved, prioritize the outcomes on which to focus the evaluation, and take contacts to later identify the key informants to substantiate the results.
3. Semi-structured qualitative interviews with key knowledgeable informants, in order to validate the outcome statements formulated at point 2 and eventually identify further outcomes, their enabling or hindering factors, as well as the MTA innovation trajectory

A. Outcome Identification Workshop

Taking advantage of the II National MTA meeting, held on 24-25 September 2024 in Bogota, we carried out a participatory activity to identify with the representatives of the MTAs, the most significant outcomes that have been achieved as a result of the existence and implementation of the MTAs, and thus prioritize those that should be substantiated through key informant interviews.

During the workshop, the MTA representations were divided into 5 working groups, according to a regional logic:

- Caribbean Group (Córdoba, Sucre, Bolívar, MCGA (Atlántico, Magdalena, Cesar, La Guajira), San Andrés , Providencia and Santa Catalina.
- North Andean Group (Antioquia, Santander, Norte de Santander, Boyacá).
- Orinoquia and Amazonia Group (Meta, Casanare, Vichada, Arauca, Caqueta, Amazonas, Putumayo)
- Pacific Group (Nariño, Valle, Cauca)
- Andean Group (Risaralda, Quindío, Huila, Tolima, Caldas).

First, the participants filled out collaboratively a matrix, one for each MTA, with the following information:

- Name of the MTA
- Change in practice or behaviour (describe who is doing something differently thanks to the existence of the MTA or its products/newsletters/recommendations)
- Who are the actors who made this change?
- How long has this change been taking place?
- How has the MTA contributed to the change?
- How did other factors or other actors contribute to this change?
- Why is this change important?

Subsequently, each regional working group was asked to identify the 3 most significant change among those described for the MTAs in their group. They then took turns to present these changes.

The report from the workshop is part of a publication led by FAO on the National MTA meeting, which celebrated ten years of implementation of the MTAs in Colombia. The report is also available from the authors upon request.

After the workshop, the evaluation team (researchers from the Alliance authoring this report) and key researchers from the Alliance as well as staff from FAO engaged in the coordination, support and implementation of the MTAs met to identify the outcomes to be validated through key informant interviews. Thirteen outcomes regarding 10 MTA were prioritized.

Subsequently, the evaluation team virtually met with the coordinators of the ten MTAs to have further details on the outcomes and finalize the formulation of the outcome statement.

After this further stage of refinement, 5 outcomes regarding 5 MTAs were finally selected for substantiation with key informant interviews, hierarchically/institutionally independent of the MTA coordinators.

A caveat is due: by the nature of the MTA, a platform of actors who voluntarily meet every month to analyze forecasts and develop recommendations that are then shared in an agroclimatic bulletin, there are no fully independent actors from the MTA that can confirm the changes brought about by the existence and implementation of the MTA.

The key informants providing substantiation to the outcomes formulated by the coordinators of the MTAs are therefore participants of the MTA that can provide evidence of the outcomes identified through their knowledge and experience, as well as identifying additional outcomes.

B. Outcome statements

The final outcome statements validated through the key informant interviews are presented in Table 1.

Table 1. Initial outcome statements

Local Technical Agroclimatic Committe (MTA)	Outcome (Spanish)	Outcome (English)
Cauca	<p>Cambio: Desde 2015, la MTA se enfoca en generar estrategias de comunicación diferenciales acorde a las dinámicas territoriales.</p> <p>Importancia: Aumenta el alcance la información y permite que los agricultores toman decisiones con base en la información del boletín</p> <p>Contribución de la MTA: Espacio al que se han vinculado diversos proyectos de desarrollo en los cuales se han fortalecido sus acciones al tiempo que aumenta la difusión de la información</p> <p>Contribución de otros actores/factores: Mesa Científica Innovación Agropecuaria, promociono las estrategias de comunicación antes de pandemia en: emisoras locales, párrocos/megáfono, etc. 2021 retomamos y</p>	<p>Outcome: Since 2015, the MTA has focused on generating differential communication strategies according to territorial dynamics.</p> <p>Significance: Increases the scope of information and allows farmers to make decisions based on the information in the bulletin.</p> <p>Contribution of the MTA: Space that has been linked to various development projects in which its actions have been strengthened while increasing the dissemination of information.</p> <p>Contribution of other actors/factors: Mesa Científica Innovación Agropecuaria, promoted the communication strategies before the pandemic in: local radio stations, parish priests/megaphone, etc.</p>

	<p>se fortalecieron estrategias virtuales: grupo WhatsApp</p>	<p>2021 we took up and strengthened virtual strategies: WhatsApp group.</p>
<p>MCGA (Magdalena, Cesar, La Guajira and Atlántico)</p>	<p>Cambio: Desde 2019, la MTA MCGA funciona a través de una secretaria técnica que lidera la MTA y establece los anfitriones de la MTA durante cada año calendario. Dado que la MTA opera de forma híbrida desde la Pandemia la secretaría técnica se encarga de lograr que cada mes el anfitrión realice la mesa técnica mientras que Agrosavia pone el link de la reunión, Fedearroz el meteorologo y Cenipalma genera el enlace de inscripción.</p> <p>Importancia: Garantiza la sostenibilidad y la operatividad de la MTA y permite la sistematización de bases de datos, formatos, reuniones, boletines. Permite llevar un orden en las actividades y proyecciones de la MTA</p> <p>Contribución de la MTA: Debido al contexto de los diferentes departamentos que abarca la MTA, cuando se establecieron los Anfitriones, este proceso conlleva a la descentralización de la MTA, como proceso promovido desde la MTA por sus mismos actores y no por FAO. Voluntad interna de los miembros de no depender del convenio.</p> <p>Contribución de otros factores/actores: No había un liderazgo claro. Falta o demora de firma del convenio.</p>	<p>Outcome: As of 2019, the MCGA MTA operates through a technical secretariat that leads the MTA and establishes the MTA hosts during each calendar year. Given that the MTA operates in a hybrid way since the Pandemic the technical secretariat is responsible for ensuring that each month the host holds the technical table while Agrosavia provides the meeting link, Fedearroz the meteorologist and Cenipalma generates the registration link.</p> <p>Significance: It guarantees the sustainability and operability of the MTA and allows the systematization of databases, formats, meetings and bulletins. It allows to keep order in the MTA's activities and projections.</p> <p>Contribution of the MTA: Due to the context of the different departments covered by the MTA, when the Hosts were established, this process led to the decentralization of the MTA, as a process promoted from the MTA by its own actors and not by FAO. Internal willingness of the members not to depend on the agreement.</p> <p>Contribution of other factors/actors: There was no clear leadership. Lack of or delay in signing the agreement.</p>
<p>MCGA (Magdalena, Cesar, La Guajira and Atlántico)</p>	<p>Cambio: Desde 2019 los gremios bananero, palmero, arrocero y cafetero han unificado el criterio de difusión de la información basado en la producción y pronóstico que se genera en la MTA. Se une la gestión del riesgo a tomar las recomendaciones e incluirlas en el boletín. Antes cada gremio usaba la información climática generada al interior de los mismos.</p> <p>Importancia: Se ha podido generar recomendaciones de manera articulada, unir esfuerzos y conocimientos generando boletines más integrales y de mayor alcance.</p> <p>Contribución de la MTA: Fue el espacio donde se reunieron los actores para articular los criterios. Después, cada gremio genera reuniones internas que les permiten desarrollar recomendaciones más precisas</p>	<p>Outcome: Since 2019, the banana, palm, rice and coffee unions have unified the criteria for disseminating information based on the production and forecasts generated by the MTA. Risk management is now united in taking the recommendations and including them in the bulletin. Previously, each guild used the climatic information generated within them.</p> <p>Significance: It has been possible to generate recommendations in an articulated manner, join efforts and knowledge, generating more comprehensive and far-reaching bulletins.</p> <p>Contribution of the MTA: It was the space where the actors met to articulate the criteria. Afterwards, each guild generates internal meetings that allow them to</p>

	<p>tomando en cuenta la información de la MTA y presentándolas en el boletín.</p> <p>Contribución de otros factores/actores: Meteorólogo de Fedearroz, que por su componente agrícola mejora las predicciones que se hacen. Las recomendaciones sobre gestión de riesgo han sido una solicitud desde el ministerio con un mayor interés en el departamento de La Guajira.</p>	<p>develop more precise recommendations taking into account the information from the MTA and presenting them in the bulletin.</p> <p>Contribution of other factors/actors: Fedearroz meteorologist, whose agricultural component improves the predictions made. The recommendations on risk management have been a request from the ministry with a greater interest in the department of La Guajira.</p>
<p>Risaralda</p>	<p>Cambio: Desde 2021, Los actores territoriales de gestión del riesgo, como los bomberos, las policía y contratistas, usan la información de la MTA para planificar sus intervenciones.</p> <p>Importancia: Se han podido evitar incendios y atenderlos más rápido, hubo capacidad de respuesta mejor</p> <p>Contribución de la MTA: La MTA como espacio de encuentro y discusión provee insumos de información para la toma de decisiones. Los boletines y pronósticos son muy apropiados por estos sectores</p> <p>Contribución de otros actores/factores: La ocurrencia del fenómeno de La Niña y la existencia del comité de incendios de cobertura vegetal y forestal</p>	<p>Outcome: Since 2021, territorial risk management actors, such as fire brigades, police and contractors, use MTA information to plan their interventions.</p> <p>Significance: Fires have been prevented and attended more quickly, there was a better response capacity.</p> <p>Contribution of the MTA: The MTA as a meeting and discussion space provides information inputs for decision making. The bulletins and forecasts are very well received by these sectors.</p> <p>Contribution of other actors/factors: The occurrence of the La Niña phenomenon and the existence of the committee on vegetation and forest fires.</p>
<p>Sucre/Cordoba</p>	<p>Cambio: Desde 2015, el gremio de Arroceros (Fedearroz), gremio de cerealistas(fenalce) gremio ganadero(coogasamo) asociaciones ANOC, Asofasam, Asopafu usaron la información de la mesa técnica para planificar actividades.</p> <p>Importancia: La correcta toma de decisiones en términos de la fecha de siembra evita perdidas millonarias para los gremios y los agricultores.</p> <p>Contribución de la MTA: Agro-climatic information and recommendations</p> <p>Contribución de otros actores/factores: Fedearroz y Fenalce colocaron un meteorologo cada uno para asegurar la continuidad de la MTA. Investigación de CIAT para medir el impacto.</p>	<p>Outcome: Since 2015, the rice growers' guild (Fedearroz), cereal growers' guild (fenalce), livestock farmers' guild (coogasamo), ANOC associations, Asofasam, Asopafu have used the information from the technical roundtable to plan activities.</p> <p>Significance: Correct decision making in terms of planting date avoids millions of dollars in losses for unions and farmers.</p> <p>Contribution of the MTA: Agro-climatic information and recommendations</p> <p>Contribution of other actors/factors: Fedearroz and Fenalce each placed a meteorologist to ensure continuity of the MTA. CIAT research to measure impact</p>

C. Interview guideline

The semi-structured interview guideline had the following structure:

1. MTA objectives and governance

- Respondent information (role, years of engagement in the MTA)
- Definition of the MTA
 - MTA objectives and any changes to these objectives
- Actors engaged in the MTA approach and their roles
 - Changes in the roles of units involved
 - Women and minorities' participation in the MTAs
- Changes in how the MTA functions
- Milestones in the MTA's history
- Tensions and challenges in MTA implementation
- Contextual factors affecting MTA evolution

2. Identification of outcomes by respondents

- Changes achieved during the MTA implementation according to the respondents' knowledge or experience

3. Substantiation of outcomes pre-identified by the evaluation team and MTA coordinators

- Extent of agreement among respondents with the outcomes pre-identified
- Motivation of the response

D. Outcome substantiation interviews

For the substantiation (evidence, validation) of the outcomes, 17 interviews were conducted between November 14 and December 6, 2024, with informants from MTA participating institutions in various regions of Colombia.

The MTAs in which the interviews were conducted were those of Cauca, Cordoba, Sucre, Risaralda and MCGA (Magdalena, Cesar, La Guajira and Atlántico). The research consisted of in-depth interviews with 17 key informants, of which 11 were males and 6 females (see Table 1).

All of the interviews were conducted in Spanish, online, with an average duration of 45 minutes, recorded and transcribed in Word in Spanish. Prior to the interviews, all the participants were briefed on the research, and informed consent was obtained from each participant.

The participants were fully informed that participation would be voluntary and treated in confidence, although they were going on the record with their answers, and that they could withdraw at any time without prejudice or any negative impacts. Sampling was purposively conducted based on the criterion that informants had been involved in the MTA and knowledgeable of the specific outcome to be validated, as aforementioned.

The 17 participants represented various sectors and institutions in the different regions of Colombia. The sample included representatives of farmer organizations, risk management organizations, agricultural extension services and individual farmers.

Table 2 Interviewed informants by location and gender

No.	MTA	No. of outcomes	No. of respondents	Type of institution	By gender	
					No. of male respondents	No. of female respondents
1	Cauca	1	3	3 Producers' organizations (gremios)	2	1
2	Risaralda	1	3	2 Fire brigades 1 Environmental risk management	2	1
3	Sucre	1	3	2 Farmers 1 Women Producers' association	1	1
4	Córdoba	1	2	1 Extension services 2 Producers' organization	2	1
5	MCGA (Magdalena, Cesar, La Guajira, Atlántico)	2	6	4 Producers' organizations 1 Education services 1 Environmental risk management	4	2
Total			17		11	6

Source: Interviews conducted in October 2024

Table 3 Interviewed informants by administration level and role in the MTA approach

No.	Department	Institution	Position	Role in the ACB approach	Date of interview	Interview format
1	Cauca	Federación Nacional de Cafeteros	Education program coordination	Representative of the coffee sector that receives agro-climatic information and generates recommendations for the local context. Additionally, develops extension activities for the transmission of the recommendations generated.	21 November 2024	Online
2	Cauca	ASOHOFrucol	Coordinator of the National Plan for the Promotion of Horticulture and Horticulture	Representative of the horticultural sector that receives agroclimatic information and generates recommendations for the local context. Additionally, develops extension activities for the transmission of the recommendations generated.	18 November 2024	Online
3	Cauca	Comite de Ganaderos del Cauca	General Manager	Representative of the livestock sector that receives agro-climatic information and generates recommendations for the local context. Additionally, develops extension activities for the transmission of the recommendations generated.	22 November 2024	Online
4	Risaralda	CARDER	Risk management consultant	Representative of an environmental risk management institution that develops the risk management recommendations of the bulletin.	14 November 2024	Online
5	Risaralda	Unidad de bomberos de Santa Rosa de Cabal	Deputy Lieutenant of the Santa Rosa de Cabal Fire Department, Coordinator of the Risaralda Department's vegetation cover fire brigade.	Representative of an environmental risk management institution that develops the bulletin's risk management recommendations. As coordinator of the vegetation cover fire brigade, invites MTA stakeholders to the committee for the dissemination of agro-climatic information.	19 November 2024	Online

6	Risaralda	Unidad de bomberos de Pueblo Rico	Pueblo Rico Fire Department Communication Secretary	Representative of an environmental risk management institution that develops the risk management recommendations of the bulletin.	20 November 2024	Online
7	Córdoba	Distribuciones H y H	Agricultural technician	Agribusiness extensionist bringing agri-climatic information to farmers	6 December 2024	Online
8	Córdoba	CONALGODÓN	Regional Technical Secretary	Representative of the cotton sector that participates in the MTA and generates recommendations in the agro-climatic bulletin.	22 November 2024	Online
9	Sucre	Farmer	Farmer	Farmer with more than 30 years of experience. Member of the board of FEDEARROZ Monteria section Representative of the rice sector in the MTA contributing to the dissemination of information.	5 December 2024	Online
10	Sucre	Farmer	Farmer	Representative of a women's association for the development of the region. Farmer and representative of the rice sector in the MTA contributing to the dissemination of information	21 November 2024	Online
11	Sucre	Farmer	Farmer	Farmer engaged in primary production and post-harvest activities in the rice sector. Representative of the rice sector in the MTA contributing to the dissemination of information.	22 November 2024	Online
12	MCGA	SENA	Professional Agricultural Training Center	MTA participant from the education sector. Educator of agricultural extensionists	19 November 2024	Online
13	MCGA	FEDEARROZ	Researcher in research and technology transfer	Member of the MTA technical secretariat. Representative of the rice sector. Responsible for the generation of agroclimatic recommendations for the rice sector bulletin.	25 November 2024	Online
14	MCGA	Corpogujaira	Professional specialized in the group of environmental-territorial planning.	Member of the MTA technical secretariat. Representative of the rice sector. Responsible for the generation of agro-climatic recommendations for the bulletin.	25 November 2024	Online

15	MCGA	CENIPALMA	Researcher in the geomatics area of the agronomy program.	Member of the MTA technical secretariat. Representative of the palm sector. Responsible for the generation of agroclimatic recommendations for the palm sector bulletin.	22 November 2024	Online
16	MCGA	Federación Nacional de Cafeteros		Representative of the coffee sector that receives agro-climatic information and generates recommendations for the local context. Additionally, develops extension activities for the transmission of the recommendations generated.	20 November 2024	Online
17	MCGA	ASBAMA	Administrative and Project Manager	Representative of the banana sector that receives agro-climatic information and generates recommendations for the local context. Additionally, develops extension activities for the transmission of the recommendations generated.	19 November 2024	Online

Source: Interviews conducted in November and December 2024

E. Data Analysis and reporting

The data collected from the interviews were manually transcribed in Spanish and systematically reviewed, with double-checks against the original recordings to ensure data quality.

The interview transcripts were organized according to the interview guide, closely matching the respondents' original answers.

The collected data was thematically analyzed in digital form using Microsoft Excel. The method for identifying, analyzing, and reporting themes from the data transcripts was used to develop the analysis grid. This grid disaggregated the data into three main sections, mirroring the interview guidelines.

The results are reported according to the following structure:

1. The key elements from interviews with the MTAs coordinators
2. The results from the key informant interviews:
 - a. The trajectory of the MTAs
 - b. The outcomes they contributed to generate according to respondents
 - c. The substantiation by respondents of the pre-identified outcomes

3. Results

3.1. Highlights from MTA Coordinator's interviews

Since their inception, the MTAs have been functioning with funding and technical support from agreements between the MADR and CIAT (then the name of the Alliance) and since 2019, through agreements between the MADR and FAO. When there is no agreement in place, the MTAs look for creative solutions to maintain their operation and engage participants. The responses of the coordinators (and later the key informants) reflect this. Moreover, the change in institutional support, such as the decentralisation of the meetings of the MTA, as well as in the language used (agroclimatic literacy). The pandemic also brought in changes in participation dynamics, boosting the implementation of virtual or hybrid meetings and of Whatsapp groups to maintain communication flow.

MCGA

In 2018, the MTA (Mesa Técnica Agroclimática) faced problems due to the termination of its agreement, which caused an interruption of its meetings between January and April. A first solution was provided by Fedearroz then assigned meteorologists to generate the necessary forecasts to continue with the meetings in those months even without an agreement between the Ministry and FAO/CIAT. The inclusion of the Fedearroz meteorologist has strengthened the MTA by adding a specialized agricultural focus, which has led to more comprehensive recommendations. Currently, the MTA is also supported by an IDEAM meteorologist.

To ensure the continuity of the MTA, a system of decentralised "hosts" (anfitriones) and a technical secretariat composed of Agrosavia, Fedearroz, Cenipalma and FAO was created, which leads and organizes the hosts of the table each year. Since the pandemic, the MTA operates in a hybrid manner, with the technical secretariat managing the technical roundtable each month, Agrosavia providing the meeting link, Fedearroz providing the meteorologist (Francisco), and Cenipalma generating the registration link. To date, decentralised hosts included organizations such as Corpoguajira, Corpoamar, Asbama, Augura, SENA, and UNAD.

The producer guilds participating in the MTA hold internal meetings in the week following the MTA monthly meeting in order to develop more precise recommendations based on the climatic information discussed, which they present in the bulletin and share with their members, such as farmers and marketers (e.g. banana growers).

Finally, recommendations are also integrated into a risk management section of the bulletin, in response to a request from the ministry with special interest in the department of La Guajira.

Cauca

Between 2016 and 2019, the Cauca MTA decided to focus its communication strategy on agroclimatic risk leveraging on the network provided across the region by academia, public institutions, social organizations, and associations. The strategy included tools such as local radio stations, communicators translating bulletins into essential information, and posters distributed in communities, supported by projects funded through government royalties.

Although the pandemic in 2020 temporarily halted activities, efforts resumed in 2021 with a virtual focus, including WhatsApp groups with over 200 participants and bulletin formats adapted for mobile devices. However, challenges persist, such as limited financial resources, reduced participation in virtual meetings, and connectivity barriers.

The MTA sought to diversify its communication channels by reactivating local radio stations, creating brief podcasts, and exploring visual formats for quick decision-making in productive systems. Coordination with key actors such as Agrosavia, producer guilds (Fedepanela, Asufrucol, FEDECAFE), and the University of Cauca was crucial to sustain its initiatives, despite frequent changes in government authorities that impacted continuity.

In Cauca, the coffee sector is a priority, with 99,000 hectares cultivated by 44,000 small producers who require practical tools for decision-making. Additionally, there is a recognized need for a communication strategy targeting young people to rejuvenate the agricultural sector, given the aging rural population and the limited technical preparation of older generations.

The year 2024 will close with a celebration of the 100th bulletin at an event at the University of Cauca, highlighting the MTA's commitment to adapting and strengthening its impact in the region.

Risaralda

The Risaralda MTA was established during the pandemic with support from the Quindío and Caldas committees, and has since taken off through regular, open meetings that have incorporated new participants. These include local institutions and disaster risk management actors such as firefighters, civil defense, and water utilities, which use bulletins and forecasts as essential tools for disaster management.

The change in the language used to define the committee, from "Technical Agroclimatic (round)Table" to "Territorial Agroclimatic (round)Table" reflects an effort to improve communication, particularly in areas with indigenous populations, by shifting from technical language to a more inclusive and accessible approach. A guided participation workshop in 2022 was held to enhance communication, progressing from initial agroclimatic literacy to a more robust agroclimatic culture. This effort has connected technical and institutional actors with relevant climate information, although reaching small-scale farmers remains a challenge.

The involvement of risk management actors, such as firefighters and national parks, has been crucial for disaster forecasting and response, reducing the number of fires and improving planning during events like El Niño. However, the MTA faces challenges with continuity and

active participation following leadership changes in the mayor's office, highlighting the importance of sustained public institutional commitment to ensure long-term impact.

Since its inception, the MTA has alternated between virtual and in-person meetings to decentralize activities, encouraging different actors to host meetings. Various communication channels, such as WhatsApp, videos, bulletins, conferences, and social media broadcasts, have been utilized to reach a broader audience.

Córdoba/ Sucre

The Córdoba MTA began in 2014 and inspired the creation of the MTA in Sucre in 2015, both coordinated by Fedearroz at that time. Both tables have strongly collaborated since then, sharing resources such as Fedearroz's meteorologist and a WhatsApp group that facilitates information dissemination, particularly among public institutions and farmers with limited access.

Unlike other tables, risk management actors do not actively participate, reflecting the exclusively agricultural focus of these MTAs.

In 2023, with support from FAO, a proposal was made to decentralize the monthly meetings, taking them to municipalities in Sucre (with San Marcos as the main venue) and Córdoba (Montería and Cereté). The decentralization aims to involve more people from the subregions (five in Sucre and three in Córdoba) and engage municipal governments in logistical support (invitations, refreshments).

The tables in Córdoba and Sucre do not have a formalization decree, operating since 2014-2015 under voluntary agreements. There is an interest in formalizing them to integrate them into the departmental climate change plans and ensure their long-term sustainability.

Some key challenges are highlighted:

- Lack of systematic monitoring that would allow to measure the adoption and impact of the use of the forecasts and recommendations in the bulletin.
- The lack of consistent commitment from officials and turnover in public institutions affects the continuity of the meetings.
- There is an effort to emphasize that the MTAs are not the property of organizations like Fedearroz or Fenalce, but rather a collective effort.
- Decentralization has allowed the participation of new actors and greater regional commitment, but it requires more resources and planning. Its success also depends on the commitment of local actors, and some hesitate when they realize the responsibilities involved in hosting a meeting.

3.2. Outcome substantiation interviews

The 17 informants have been engaged in the MTAs on average for five years: four respondents have been recently engaged (1 to 2 years); five respondents have been engaged between 3 and 5 years; and 3 have been engaged for 6 to 7 years; and 5 for 9 to 10 years. The knowledge and experience of the MTAs is therefore quite extensive for the large majority of respondents.

Regarding their role in the MTAs some state how they have become more actively involved over time, contributing recommendations and facilitating collaboration between stakeholders. Some participants have taken on more organizational and leadership roles within the mesas, managing logistics and coordinating meetings, but also offering expert advice.

3.2.1. The trajectory of the MTAs

Defining the MTAs

The 17 interviewees defined the MTAs as **spaces for collaboration** between various entities and organizations that focus on analyzing climate and its effects on agricultural production.

They consider that their main purpose is to **share updated information on climate phenomena** and generate recommendations **to improve decision making** in sectors such as agriculture and livestock as well as **risk management**.

They also serve as a **meeting place and dialogue** between different actors who exchange knowledge and work together to reduce climate risks, apply agro-climatic forecasts and improve agricultural production based on weather conditions.

In some responses, the MTA is framed as **a tool for forecasting and alerting**, with practical applications for managing specific agricultural risks (e.g., El Niño, La Niña).

Other responses focus more on the **educational aspect**, describing how participants learn about climate phenomena and how to integrate them into agricultural planning.

Depending on the type of respondent, the definition also includes a focus on a particular production sector, like fruits, coffee, or rice farming, while others refer specific institutions (e.g., IDEAM, FENALCE, FEDEARROZ) and the role they play in providing meteorological data and forecasts.

"It is a compendium where we are given approximate information on how the climate will behave and from there we, as farmers and industrialists, can make decisions for the planting season, for the harvesting season. (Farmer)

"For us it is a space in which we can work together with other sectors, with other actors in the territory to be able to make decisions based on climate information that is generated at the table and that we can act in our case, well, directly with our producers. (Producer organization)

"It is a space for information management for decision making and climate risk reduction, based on technical-scientific analysis of climate conditions (current, past and future) to assess risks, damages and losses in the agricultural sector. (Environmental risk management)

"It is a space where the entities that generate climate information and those that need climate information converge. (Producer organization)

Evolution of the MTAs

The MTAs have expanded beyond their original reach, with some moving from a single municipality to include multiple regions or departments, thus reaching more agricultural producers.

This scaling also led to the integration of new actors, such as environmental groups and risk management institutions. For some, the MTAs have become more specialized, with actors now providing specific recommendations based on detailed climate data analysis, addressing areas such as risk management and environmental concerns.

The objective of Cordoba and Sucre MTAs has stayed the same, while it evolved over time for the other MTAs.

MCGA MTA:

Four respondents mentioned how initially, the producer associations (gremios) met without much clarity on applicability. Over time, the objective has been enriched, with a more structured bulletin and clear technical recommendations, focused on transmitting more user-friendly and useful information for producers, reflected in a more accessible newsletter. Moreover, the information expanded from climate information to information about experiences in technology and environmental issues such as mangroves or hydrological changes.

Risaralda MTA:

For Risaralda, two respondents mention how the initial objective was to share climate information, over time evolving towards specific recommendations on risk Management, not only regarding rain, but also other climatic phenomena and health related issues.

Cauca MTA:

Two respondents from the Cauca MTA say it has improved in the way of explaining the forecasts, adapting to the needs of the participants and to provide information useful for farmers but also agribusinesses.

Actors participating in the MTAs

Participants in the MTAs include a variety of organizations from both public and private sectors, as well as academic institutions Table 4. These include:

- **Universities:** Such as the University of Cauca, University of Sucre, and University of Magdalena.

- **Government Entities:** Local government bodies, municipal risk management teams, as well as entities like environmental risk management corporations (CARDER), and the Colombian Agriculture and Livestock Institute (ICA).
- **Producer organizations:** federations or guilds (Fedearroz, FENALCE, ASOHOFRUCOL, Federation of Coffee Growers, Federation of Livestock Farmers, Fedepanela) and their supporting extension services like Cenipalma, but also local producer associations.
- **Research and Technical Institutions:** the national agricultural research corporation (Agrosavia), the National Education Service (SENA), and independent agronomists or technical experts.
- **Emergency and Risk Management Groups:** Local fire brigades, the police, civil defense.

The type of actors mentioned by respondents participating in the 5 MTAs reflect the diversity of productive systems and of the stakeholders who initiated the MTAs or took leadership over time. For instance, two of the most ancient MTAs, Cordoba and Sucre are clearly focused on the productive systems of the leading guilds, and the actors supporting them such as research institutes and universities. On the other side, a very large and diverse MTA such as the one from the Caribbean regions (MCGA) has a wide diversity of actors, representing the diversity of productive systems in these regions (fruits, livestock, export crops etc), academia and education services, risk management entities, as well as insurers, and parks.

Table 4. Types of actors engaged in the MTA according to respondents

MTA	Stakeholders regularly participating in the MTA meetings
Cauca	Universities, governmental and private entities, individuals, and municipal risk management teams. FAO, ASOHOFRUCOL, Federación de Ganaderos, Federación de Cafeteros, Fedepanela, Universidad del Cauca, Agrosavia.
Cordoba	Fedearroz, FENALCE, input providers, independent technicians, farmers, Agrosavia, ICA, independent agronomists and the University of Córdoba.
Sucre	Fedearroz, UNDP, Universidad de Sucre, Fedegan, Conalgodon, Corpomojana.
Risaralda	CARDER, fire brigades, civil defense, local government, environmental risk management, Vegetation Fire Commission, FAO
MCGA	Fedearroz, Fedepalma, Asbama, Asohofrucol, Fedegan, Federacion de cafeteros, Fedecacao, Cenipalma, Agrosavia, universities, regional corporations of Magdalena and La Guajira, SENA, parks, risk management entities, and insurance companies (such as Mapfre), FAO, individual producers

All MTAs have seen an increase in the actors involved as the MTAs work attracted interest from multiple sectors of society.

In Cauca, the inclusion of technological development centres such as Creativ has updated how actors interact and provided new digital tools to improve participation, especially important

given security reasons in the area that sometimes affect the possibility to have in person meetings.

MCGA respondents detailed the changes in participating actors. Over time, due to increasing interest, the representativeness and participation of diverse actors has increased, such as with the inclusion of the insurance sector, which benefits from climate information, but also Agrosavia and Cenipalma. There is greater involvement of actors that disseminate meteorological information. For example: FEDEGAN and ASBAMA with their agrometeorological networks and producers using rain gauges.

There have also been adjustments according to regional leadership and dynamics. In the Atlántico, the integration of sectors such as cattle raising broadened the scope.

However, there is a perceived lack of active participation of some local governments in key issues such as risk prevention.

Engagement of women and minorities

Interviewees were asked about the engagement of women and minorities in the MTAs.

Cauca MTA respondents consider that women participate actively as several entities in Cauca are headed by women, including at guilds and government level, or their focal points are women. However, there has been very limited participation of indigenous communities, such as the Misak, and afro-descendant communities.

Cordoba MTA respondents consider that women participation is relatively, around 20%, whilst there is no indigenous or minorities' participation.

Sucre MTA respondents have seen a rise in women participation with the inclusion of a women producers' association, and consider women make 30 to 40% of the MTA participants. Some leaderships of ethnic minorities (e.g. cabildo de Monte Grande) and LGBTQ groups interested in climate related information also participate.

Risaralda MTA respondents say there is no participation of women associations or ethnic minorities, although efforts are made to reach these groups via information dissemination on social media. Honestly, it would be a tragedy to say yes, because I have not seen much participation. You've heard that they've brought successful experiences, but I don't see active participation from women or minorities.

MCGA MTA respondents consider there is a good participation of women as leaders of some institutions. On the contrary, indigenous participation is limited, although they have assisted sporadically, even though there is an effort to systematically invite them to participate. Also, it depends on the leadership and location of the meetings, as indigenous population is often located in remote areas, but also because the technical language is a barrier. When meetings are held in Santa Marta however, indigenous groups tend to participate.

Changes in the functioning of the MTAs

The Cauca MTA has improved in terms of systematization and regularity of the climatic information provided, making the bulletin more attractive, which has fostered participation. Although attendance at meetings is complex, a Whatsapp chat group allows constant communication.

In 2024, the roundtable was decentralized, allowing the participation of more peripheral municipalities. This brought the process closer to the territorial reality and allowed greater access to knowledge.

For what concerns the Sucre MTA, respondents say there has been a systematization effort through the publication of a book on “Myths and beliefs of the past”. As for the case of Cauca, they consider that Whatsapp groups and decentralised meetings in different localities have increased access to information.

In the Risaralda MTA, decentralisation is also perceived as revitalising participation by engaging diverse actors more closely. Moreover, the expansion of themes addressed by the MTA, from meteorological alerts and advisory to risk management including fires, and pests information has improved its reach and relevance.

MCGA informants discuss the MTA specific challenges related to its regional reach (four departments). They changed their governance to define “hosts” (anfitriones) for decentralised MTA meetings. Challenges arise as the convener institutions need support for basic services, such as food for the event, the ability to bring in the meteorologist and so on.

Additionally, they tried to bring the MTA closer to the farmers through field trips to agricultural plots, in order to leave the “auditorium”.

The pandemic brought in hybrid meetings, virtual and in person, increasing flexibility of participation. The themes addressed also expanded towards other themes such as irrigation or plant health.

The MTA has officially implemented a “technical secretary” for its management, formalized through national norms.

Key moments in the history of the MTA

Milestones

For Cauca, at the end of 2023, extreme weather events (rains, droughts, fires) led to increased communication and coordination, with contingency plans for affected farmers. Constant work and information generation, with key people like the assigned meteorologist keeping the process alive, played an important role. The inclusion of entities contributing knowledge and technologies, such as sensors and maps, was also a milestone.

One Sucre respondent considers that the expansion to other municipalities, especially those with different climates and water sources, has been particularly important and positive. Also, the independence of the MTA from political affiliation has built trust from farmers in its recommendations.

For one Risaralda respondent, the accurate climate predictions, particularly regarding reduced rainfall at the beginning of the year, allowed for preparations and drills, benefiting areas like Tolima.

For another, the integration of new actors and the shift to a decentralised table have been important milestones, as well as the evolution towards recommendations for risk management.

One MCGA respondent considers that the commitment of Fedearroz when the agreement with the Ministry expired, by sending a meteorologist during the period without an agreement, was key to its stability and success. Likewise, another respondent considers that continuity during

the pandemic was crucial for maintaining the MTA's relevance, increasing farmer participation and interest in climate information.

Another respondent identifies as key milestones included the start of meetings, climate literacy efforts, creation of the technical secretariat, and inter-MTAs meetings. Finally, the inclusion of Atlántico in 2019 was also a key milestone.

Tensions

In terms of tensions, for Cordoba, a difficult moment happened when an El Niño phenomenon was predicted but did not occur, leading some farmers not to plant due to fear of climate impacts. Tensions also arose over the need for more accurate information, as climate behavior varies across municipalities and the network of meteorological stations was not sufficiently extensive for detailed data.

In Cauca, the lack of resources causes fatigue, as it makes it difficult to maintain operations. However, committed individuals like staff from Agrosavia maintain the spaces active.

Additionally, the absence of information at the end of agreements with the Ministry affected the process, making it difficult for the table to operate effectively. There were also issues with FAO's availability to support validations.

For MCGA, a critical moment came when the contract with FAO ended the contract, leaving the table without a meteorologist. A fundraiser was organized to keep him involved. Even without a contract, the table continued functioning and meeting, and his participation has been consistent over the years. Each new year faces tensions due to delays in agreements, making normal operation difficult. Fedearroz' contribution has been crucial for keeping operations going, especially with the lack of continuity in agreements and specialized technical support like meteorologists.

Contextual factors

Respondents highlighted factors hindering or supporting the evolution of the MTAs.

Government changes affect continuity, and the constant turnover in organizations also impacts the process. The lack of resources to drive and maintain operations presents challenges. Security issues and poor conditions of tertiary roads made it difficult to access certain areas of Cauca, hindering the decentralization and operation of the table.

High precipitation and infrastructure limitations in the Córdoba area have affected the effectiveness of measures taken by farmers, as drainage systems aren't always sufficient to manage excess water. Additionally, the lack of state support for land improvement and drainage is also a significant factor.

Difficulties have arisen due to the lack of formal recognition and adequate funding for the MTAs, although the Nationally Determined Contribution and the Law 2169 provided some regulatory support.

At the same time, environmental factors, such as fears of phenomena like El Niño and La Niña, encourage attendance at the MTA to stay informed. Social and environmental issues have been crucial, especially during the 2022 rainy season, which required alerts and coordination.

Media visibility, although sometimes insufficient, has contributed to increasing interest in climate issues. Additionally, crises like the COVID 19 pandemic have increased awareness and concern about the climate.

3.2.2. The outcomes of the MTAs identified by respondents

The outcomes identified by respondents through open-ended questions are presented in Table 5.

The 17 respondents identified 8 changes in behaviour (e.g. strategic planning), 4 changes in practices (e.g. agricultural practices), and 6 changes in interactions (articulation, collaboration). One respondent identified a less positive outcome, given the low adoption of the recommendations by livestock farmers (Cauca).

In Cauca coffee growers have implemented adaptive agricultural practices and better agricultural planning driven by the provision of up-to-date and accessible climate information. The MTA has contributed by generating daily weather information that is efficiently distributed through diverse stakeholders. Other contributing factors include the fact that the Coffee Federation has been instrumental in creating monthly agroclimatic bulletins specific to coffee, complementing the more general information provided by the MTA. Events such as COP 16 have played a role in increasing the focus on climate change, which has led to greater interest in the MTA's work. Nonetheless, the MTA faces challenges, including limited resources that affect its visibility and the scope of its activities.

In the Córdoba region, rice producers have benefited from the MTA's continuous updating of climate data, which has been used to adjust technical advice for farmers. The farmers' willingness to adopt the recommendations depends on how relevant the advice is to their specific needs, especially regarding rainfall or droughts. The MTA's information has proven important for technicians who offer targeted recommendations to improve their agricultural practices. Other key contributors to the MTA's success include the Fedearroz meteorological stations and external technical advisors.

For Sucre, rice farmers have adopted MTA recommendations for harvest planning, which have helped them avoid losses from unforeseen weather events like rain or drought. The MTA provides relevant information to farmers who traditionally relied on local knowledge, offering more accurate data. Media such as television, radio, and smartphones have made forecasts easily accessible.

Additionally, women farmers in Sucre have been adopting environmental conservation practices, leading to a reduction in input costs and an acknowledgment of their contributions to agriculture. The training and dissemination of information on sustainable practices through the MTA, with support from guilds like Fedearroz, have been vital in this process.

In Risaralda, the MTA's recommendations on land use change through burning help fire brigades prepare strategically, contributing to a 70% reduction in fire-related calls thanks to preventive rounds.

The MTA's timely forecasts on La Niña have also been essential in shaping the brigade's contingency plans, reducing risks in the rainy season. Decentralisation and precise forecasts have been the main contributions of the MTA to this change.

In addition to the fire brigades, a key change is the increased collaboration between local actors by articulating the Permanent Commission on Vegetation Fires of CARDER and the MTA. This improves the response to climate events and enhances the planning of interventions. Despite these successes, challenges persist, such as the lack of effective environmental fines for illegal burning.

In the MCGA region enhanced interaction between environmental and agricultural sectors generates climate literacy and ensures that producers receive timely and relevant climate information. This has been achieved through the decentralization of information and the sharing of meteorological data among various institutions. Additionally, the establishment of a technical secretariat and the inclusion of more stakeholders, such as rice guilds, has further strengthened the MTA's structure, enabling better dissemination of information and more informed decision-making by producers.

The MTA has also promoted greater recognition of climate change's role in agriculture, with actors in the MCGA region working together to create initiatives like a meteorological station network. Producers in this region have started to take ownership of the climate information shared by the MTA, which has led to more informed planting decisions that minimize climate risks. Regular sessions have fostered trust and facilitated learning among stakeholders, which has contributed to the ongoing support from the government.

Table 5. Outcomes identified by respondents

MTA	Outcome	Type of Outcome	Significance	Contribution of the MTA	Other contributions	Influential factors
Cauca	Increased adoption of adaptive agricultural practices, greater climate awareness among coffee growers, and better agricultural planning	Practices Behavior	More up-to-date and useful climate information for agricultural decision-making.	Generation of daily and more accessible information, efficiently distributed through sectional coordinators.	The Coffee Federation generates monthly agroclimatic bulletins specific to coffee, while the technical table provides general information.	The lack of resources limits the visibility and activities of the MTA, but some events like COP 16 have increased attention on climate change.
Cauca	Adoption for livestock producers is weak, bulletins use technical language that is difficult for an ageing population, despite awareness efforts.				.	Climatic threats generate interest in the information of the MTA, however, producers have overall low adoption of technologies;
Cauca	Fruit producers use the recommendations from the MTA to implement measures that mitigate flooding and protect crops from hail.	Practices	The mitigation measures adopted contribute to sustainability and adaptation to climate variability.	The table provides technical recommendations for drainage, fertilization, pruning, and phytosanitary practices.	Other actors such as laboratories, broadcasters, and organizations like FAO play a crucial role in disseminating the information.	It is not clearly specified, but the lack of resources and information at certain times affected the MTAs ability to generate changes.
Córdoba	The constant updating of climate data is reflected in the technical advice given to rice producers. Advice is adjusted based on the climatic conditions to maintain production in line with the forecast. Farmers adopt the advice according to their willingness.	Behavior	Updated information is valuable to farmers, allowing them to adapt their agricultural practices to climate conditions such as rainfall or droughts.	The information provided by the MTA enables technicians to make specific recommendations to improve agricultural practices. It is crucial for advisory work.	The data provided by the Fedearroz meteorological stations are accurate. Other actors also contribute their knowledge and experience to the technical table.	
Córdoba	Cotton growers made changes in crop planning,	Behavior	The importance of early planning lies in	The MTA contributes by		

	establishing their crops at the beginning of September, allowing them to make better use of the rainfall		the fact that farmers who plant on the recommended dates are more likely to take advantage of the precipitation and thus achieve better production.	providing key information for decision-making, especially regarding rainfall and climate during crucial planting periods.	
Sucre	Rice farmers use the recommendations for harvest planning	Behavior	Farmers avoid losses due to unforeseen rain or drought.	<p>The information is more relevant for certain crops during specific seasons, such as cotton between September and March-April.</p> <p>People who based their planting on traditional beliefs, now have more accurate information.</p>	Television, radio, and phone have facilitated access to information, making predictions accessible to all participants.
Sucre	Adoption of environmental conservation practices by women farmers. The participation of women in meetings and agricultural tasks has been strengthened.	Practices	<p>Reduction of costs (10%) by optimizing the use of inputs.</p> <p>Recognition of women's work in agriculture.</p>	<p>Training and information on environmental conservation, like avoiding practices like burning.</p>	<p>Access to information and the participation of guilds like Fedearroz have been key.</p> <p>Other actors, such as local entities and associations, have provided knowledge and support.</p>
Sucre	Rice farmers use the recommendations to plan the planting date.	Behavior	Planning the planting date is important because while an average hectare can yield 5 tons, some may not even reach one ton.	<p>Predictions and agroclimatic recommendations. Last year, due to the El Niño phenomenon, the table advised to be cautious with planting, which turned out to be accurate. The MTA</p>	The MTA informs us about the behavior of the river, but it does not have direct influence on the decisions about the dam.

Risaralda	<p>Fire brigades based their strategic planning on the recommendations in the bulletin:</p> <ul style="list-style-type: none"> • They follow the agricultural recommendations for land use change through burning. • The updated La Niña forecasts allowed them to prepare their actions • Debate on whether or not to conduct burns, with support or restrictions. • Preventive rounds were made 	Behavior	<p>Thanks to the recommendations, the brigade prepared, there are no fires/reduced fires as testified by the 70% reduction in fire-related calls thanks to preventive rounds.</p>	<p>helps identify the right planting date. Agricultural recommendations Forecasts</p>	<p>There is a gap in law or regulation. There is no effective environmental fine for illegal burns.</p>	
Risaralda	<p>The articulation of actors by integrating key instances such as the Permanent Commission on Vegetation Cover Fires and the MTA</p>	Interactions	<p>The integration of more actors and the improvement in information dissemination have enabled a better response to climate events and better planning of interventions.</p>	<p>The MTA has contributed to access and use of relevant information for decision-making in risk management, such as forest fire alerts and monitoring of climate phenomena. Precise forecasts The integration of new actors as well as decentralization of the MTA</p>	<p>Actors involved, such as firefighters and those responsible for the Fire Commission, have used the information to adjust their contingency plans and improve emergency response.</p>	<p>The fire at Laguna del Otún and the need to improve fire management and the accuracy of IDEAM's information were key factors in these changes.</p>
Risaralda	<p>The timely information from the table was essential in generating an effective contingency plan for the rainy season by the fire brigades</p>	Practices	<p>Risks related to the rainy season were reduced</p>		<p>Collaboration with other actors, such as the mayor's office and agricultural offices, was key in implementing alerts and plans.</p>	
MCGA (Magdalena, Cesar, La	<p>Improved understanding of climate information through climate literacy and</p>	Interactions	<p>Increase climate literacy</p>	<p>The geoportal keeps the bulletins</p>	<p>Technical advice and training of producers, with the help of</p>	



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Guajira, Atlántico)	interaction between stakeholders.				organized and operational. Climate literacy efforts. Meteorological data	extension services, has enabled better management of communication and technical content.
	Meteorological data from the network of weather stations is shared by Cenipalma with other institutions.					
	The bulletin is part of the institutional guidelines to share with producers.					
MCGA (Magdalena, Cesar, La Guajira, Atlántico)	The improvement in the MTA's structure (technical secretariat) allowed for better dissemination of information and greater integration of the rice guilds and producers.	Interactions	Increased ability of actors to make informed decisions	The table has facilitated the creation of structured bulletins and promoted climate literacy,	Guilds and external actors, such as corporations and the insurance sector, have contributed their experience and knowledge, helping with dissemination and decision-making within the table.	FEDEARROZ understood early on the importance of climate for decision-making in crops, which allowed for better structuring of climate recommendations for producers.
MCGA (Magdalena, Cesar, La Guajira, Atlántico)	Analyzing the climatic conditions affecting the coffee production process allows coffee producers to prepare in advance and minimize risks.	Behavior	Reduced risks not only for coffee growers but for all farmers, including those in cocoa, cereals, and other agricultural sectors.	A place to discuss together topics such as pest management, diseases, climate conditions, and other agricultural issues	As extension services, we continuously provide all the technical information regarding tasks, keeping producers informed.	
MCGA (Magdalena, Cesar, La Guajira, Atlántico)	The MTAs have promoted interaction between organizations, facilitating common initiatives such as the proposal for a network of meteorological stations. Producers are taking ownership of the bulletin and making decisions based on the recommendations.	Interactions Behavior	Increased recognition and ownership of information by producers. A reference for companies to generate their own information and optimize recommendations.	Regular sessions built trust among actors, promoting learning and coordination of efforts.		The usefulness of the information generated has encouraged the continuity of government support.

MCGA (Magdalena, Cesar, La Guajira, Atlántico)	Greater public participation and unity between environmental and agricultural sectors, strengthening recommendations and operational effectiveness.	Interactions	Planting decisions now minimize climate risks. Generation of specific recommendations for producers, strengthening of the technical secretariat, and operational sustainability through partnerships and commitments.	Growing recognition of the importance of the MTA by participating actors, resulting in regular sessions and useful recommendations.	Inclusion of meteorologists and experts by the Ministry, Fedearroz, and FAO.	Partial formalization through the NDC and Law 2169 facilitated the operational continuity of the technical table.
MCGA (Magdalena, Cesar, La Guajira, Atlántico)	The creation of the technical secretariat and the inclusion of Atlántico.	Interactions	They increase the effectiveness of transferring climate information and agricultural practices to producers through bulletins and community media.	Continuous and uninterrupted operation. Generation of clear and useful bulletins for different audiences.	Support from FAO, Fedearroz, Agrosavia, and autonomous corporations to ensure the sustainability of activities.	

3.2.3. Validation of pre-identified outcomes

There is strong agreement from the interviewees with the outcomes formulated by coordinators of the MTAs, showing an alignment in vision and perception. Some nuances have been presented by the interviewees, that do not alter the significance of the outcomes.

Respondents for Cauca agree that communication strategies have been tailored to local dynamics, using tools like WhatsApp, radio stations, and megaphones. One respondent considers that while communication strategies have evolved, more simplification to technical language to reach all producers is needed.

There is strong agreement that the change to a structure with a technical secretariat leading the MCGA MTA plays a key role in improving the organization and integration of actors, particularly through the effort of Agrosavia, Fedearroz, and Cenipalma.

There is also agreement for the MCGA MTA that banana, palm, rice, and coffee guilds have unified their approach to climate information, linking it to risk management for better planning and operational sustainability. However, the unification of efforts is still evolving and not yet fully established.

There is strong agreement that the information from the Risaralda MTA is used for planning fire brigades' interventions and generating preventive alerts. However, not all fire departments systematically use the information, though the most active ones do.

Finally, there is strong agreement that rice and other producers in Cordoba and Sucre use the MTA's information for planning, especially regarding planting and crop management. The specific climate forecasts help farmers plan fertilization and other activities, optimizing their operations and aligning them with favourable climate conditions.

Table 6. Validated outcome statements

MTA	Pre-identified outcome	Validation	Ajustments to the pre-identified outcome
<p>Cauca</p>	<p>Outcome: Since 2015, the MTA has focused on generating differential communication strategies according to territorial dynamics.</p> <p>Significance: Increases the scope of information and allows farmers to make decisions based on the information in the bulletin.</p> <p>Contribution of the MTA: Space that has been linked to various development projects in which its actions have been strengthened while increasing the dissemination of information.</p> <p>Contribution of other actors/factors: Mesa Científica Innovación Agropecuaria, promoted the communication strategies before the pandemic in: local radio stations, parish priests/megaphone, etc. 2021 we took up and strengthened virtual strategies: WhatsApp group.</p>	<p>2/3 Strongly Agree</p> <p>The diversity of Cauca demands strategies tailored to territorial dynamics (WhatsApp, bulletin boards, radio stations, megaphones, among others).</p> <p>Communication strategies have evolved, but their contribution has been more internal, through technical assistance and the dissemination of bulletins.</p> <p>1/3 Partially Agree</p> <p>Although processes are being generated to facilitate communication, technical language is still used, which can be exclusionary for some producers. The challenge lies in simplifying the information without losing technical accuracy</p>	<p>The outcome should be nuanced by highlighting that further efforts to simplify language used in the bulletins are needed.</p>
<p>MCGA (Magdalena, Cesar, La Guajira and Atlántico)</p>	<p>Outcome: As of 2019, the MCGA MTA operates through a technical secretariat that leads the MTA and establishes the MTA hosts during each calendar year. Given that the MTA operates in a hybrid way since the Pandemic the technical secretariat is responsible for ensuring that each month the host holds the technical table while Agrosavia provides the meeting link, Fedearroz the meteorologist and Cenipalma generates the registration link.</p> <p>Significance: It guarantees the sustainability and operability of the MTA and allows the systematization of databases,</p>	<p>3/3 Strongly Agree</p> <p>Here's the translation:</p> <p>The MTA MCGA is led by a technical secretariat that establishes the hosts, which facilitates the organization of meetings.</p> <p>The technical secretariat and the support of key actors like Agrosavia, Fedearroz, and Cenipalma play a crucial role</p>	<p>No</p>

	<p>formats, meetings and bulletins. It allows to keep order in the MTA's activities and projections.</p> <p>Contribution of the MTA: Due to the context of the different departments covered by the MTA, when the Hosts were established, this process led to the decentralization of the MTA, as a process promoted from the MTA by its own actors and not by FAO. Internal willingness of the members not to depend on the agreement.</p> <p>Contribution of other factors/actors: There was no clear leadership. Lack of or delay in signing the agreement.</p>		
<p>MCGA (Magdalena, Cesar, La Guajira and Atlántico)</p>	<p>Outcome: Since 2019, the banana, palm, rice and coffee unions have unified the criteria for disseminating information based on the production and forecasts generated by the MTA. Risk management is now united in taking the recommendations and including them in the bulletin. Previously, each guild used the climatic information generated within them.</p> <p>Significance: It has been possible to generate recommendations in an articulated manner, join efforts and knowledge, generating more comprehensive and far-reaching bulletins.</p> <p>Contribution of the MTA: It was the space where the actors met to articulate the criteria. Afterwards, each guild generates internal meetings that allow them to develop more precise recommendations taking into account the information from the MTA and presenting them in the bulletin.</p> <p>Contribution of other factors/actors: Fedearroz meteorologist, whose agricultural component improves the predictions made. The recommendations on risk management have been a request from the ministry with a greater interest in the department of La Guajira.</p>	<p>2/3 Strongly Agree</p> <p>Since 2019, the banana, palm, rice, and coffee guilds have unified their criteria on the dissemination of climate information, linking risk management to the recommendations.</p> <p>This ensures planning and operational sustainability, adjusting to the capacities of the participating institutions.</p> <p>1 Partially agree. Although there is an effort to adapt to new realities, the unification is not yet fully defined or fixed.</p>	<p>The outcome should be nuanced by stating that the unification is in progress.</p>

<p>Risaralda</p>	<p>Outcome: Since 2021, territorial risk management actors, such as fire brigades, police and contractors, use MTA information to plan their interventions.</p> <p>Significance: Fires have been prevented and attended more quickly, there was a better response capacity.</p> <p>Contribution of the MTA: The MTA as a meeting and discussion space provides information inputs for decision making. The bulletins and forecasts are very well received by these sectors.</p> <p>Contribution of other actors/factors: The occurrence of the La Niña phenomenon and the existence of the committee on vegetation and forest fires.</p>	<p>2/3 Strongly Agree</p> <p>The information from the technical table has been used to plan fire brigades' interventions.</p> <p>The information is used to plan interventions and generate preventive alerts.</p> <p>1 Partially Agree</p> <p>Not all fire departments in the region use the information systematically; some of the most active ones do use it for planning.</p>	<p>No</p>
<p>Sucre/Cordoba</p>	<p>Outcome: Since 2015, the rice growers' guild (Fedearroz), cereal growers' guild (fenalce), livestock farmers' guild (coogasamo), ANOC associations, Asofasam, Asopafu have used the information from the technical roundtable to plan activities.</p> <p>Significance: Correct decision making in terms of planting date avoids millions of dollars in losses for unions and farmers.</p> <p>Contribution of the MTA: Agro-climatic information and recommendations</p> <p>Contribution of other actors/factors: Fedearroz and Fenalce each placed a meteorologist to ensure continuity of the MTA. CIAT research to measure impact</p>	<p>5/5 Strongly Agree</p> <p>Rice growers and other guilds use the information from the MTA to plan activities. Climate information is crucial for farmers as it influences planting and crop management decisions.</p> <p>The specific forecasts help farmers make detailed decisions about the best weeks for fertilization and other activities, allowing them to adjust their operations with greater precision and take advantage of more favorable climate conditions.</p>	<p>No</p>

4. Conclusions

The MTAs (Local Technical Agroclimatic Committees - Mesa Técnica Agroclimática) in Colombia have become key spaces of transdisciplinary and multisectoral participation and collaboration.

We can identify two core elements of all MTAs:

- A space for articulating and integrating multiple actors and sectors
- A tool for analyzing climate information and developing targeted recommendations

However, the number of productive systems and the diversity of local contexts have called for tailored approaches, that each MTA has been developing according to their needs.

Some have evolved from a focus primarily on producers to addressing broader territorial risk management. This shift reflects the complex needs of diverse regions, as some MTAs are more focused on specific crops whilst other reflect the diversity of actors in territory. Environmental risk management has become a key area of use of the recommendations from the MTAs in specific regions.

In some cases, the influence of the coordinating institutions, including strong crop-focused gremios (agricultural associations), public sector agencies, and universities, shapes the MTA's priorities. MTAs led by specific guilds concentrate more on crop-specific recommendations, whereas those led by other actors or smaller/more diversified guilds tend to adopt a broader approach, incorporating a variety of sectors and perspectives.

There is strong agreement from the interviewees with the outcomes formulated by coordinators of the MTAs, showing an alignment in vision and perception. Some nuances have been presented by the interviewees, that do not alter the significance of the outcomes.

Furthermore, the interviewees identified additional outcomes, especially in the use of recommendations and forecasts for strategic planning of multiple actors (farmers, environmental risk managers, extension services) and in the articulation of stakeholders for specific purposes.

Technologies like WhatsApp have expanded access to information, particularly through decentralization, which has become a necessity due to the complexity of local territories. Decentralization is seen as a positive change but also a challenge due to the logistic burden that it can represent.

Challenges exist.

The participation of women is greater in MTAs where several entities are led by women, although in some cases such as in Sucre, the MTA has played an important role in making women's work in rice farming more visible.

An element of departure from the origins of the MTAs seem to be reflected in the need to reconnect traditional or layman language and scientific language and knowledge. Creative solutions for participation, taking advantage of digital tools and including engagement with technology development centres, have been devised, but integration of minorities still remains a challenge due to language, cultural and geographic barriers.

Moreover, the MTAs face challenges related to institutional dynamics and administrative management. The frequent change of agreements, contracts, and secretariats has disrupted the continuity and long-term impact of some MTAs. Regulatory flexibility is needed to ensure that the lessons learned and progress made are not lost with each new agreement.

The coordination of actors remains a critical function, and it is clearly acknowledged by multiple interviewees. However, the adoption of recommendations by farmers has not yet been adequately evaluated, although it is clearly perceived by the large majority of respondents, often representatives of producer organizations.

In conclusion, while the MTAs have significantly impacted their territories by improving climate literacy, promoting better agricultural practices, and fostering cross-sector collaboration, challenges remain. These include resource constraints, gaps in regulation, the need for more inclusive and accessible language and procedures, as well as the need for robust assessment of adoption and its impacts.

Strengthening monitoring and sources of funding and administrative support are key steps for consolidating the MTA as a vital tool in regional agroclimatic planning and risk management, ensuring their continued success and adaptation to evolving local needs.

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