

Participatory and solidary management for the implementation of a dried armored catfish fillet plant in fishing cooperatives of the municipality of Centro, Tabasco, Mexico

Gestión participativa y solidaria para la implementación de la secadora de filete de bagre armado en cooperativas pesqueras del municipio de Centro, Tabasco, México

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Abstract

The article designs a participatory and solidarity-based management proposal to implement an armored catfish fillet dryer in cooperatives in the municipality of Centro, Tabasco, Mexico. Using a mixed-methods approach, it integrates surveys, interviews, observation, and SWOT analysis to diagnose gaps in governance, infrastructure, and market information. The model is grounded in the Social and Solidarity Economy and in commons governance principles, and it is operationalized in four phases: participatory diagnosis, stakeholder validation, collaborative formulation, and implementation with shared monitoring. Recommendations include sanitary standardization and traceability, as well as commercial linkages with fair pricing and the inclusion of women and youth, under cooperative identity and principles. The hypothesis is partially validated: the model improves organizational cohesion, operational efficiency, and socioeconomic conditions, and contributes to Sustainable Development Goals 8, 12, and 14, while strengthening local capacities in a sustainable manner.

Resumen

El artículo diseña una propuesta de gestión participativa y solidaria para implementar una secadora de filete de bagre armado en cooperativas del municipio de Centro, Tabasco, México. Con un enfoque mixto, integra encuestas, entrevistas, observación y análisis FODA para diagnosticar brechas en gobernanza, infraestructura e información de mercado. El modelo se basa en la Economía Social y Solidaria y en principios de gobernanza de las comunidades, y se opera en cuatro fases: diagnóstico participativo, validación con actores, formulación colaborativa e implementación con monitoreo compartido. Se recomiendan la estandarización sanitaria y la trazabilidad, así como encadenamientos comerciales con precios justos e inclusión de mujeres y jóvenes, bajo identidad y principios cooperativos. La hipótesis se valida parcialmente: el modelo mejora la cohesión organizativa, la eficiencia operativa y las condiciones socioeconómicas, y contribuye a los Objetivos de Desarrollo Sostenible 8, 12 y 14, fortaleciendo capacidades locales de manera sostenible.



Fisheries management, Community participation, Food processing



Gestión de la pesca, Participación comunitaria, Procesamiento de alimentos

Area: Development of strategic leading-edge technologies and open innovation for social transformation

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Peer review under the responsibility of the Scientific Committee [<https://www.marvid.org/>]-in the contribution to the scientific, technological and innovation Peer Review Process through the training of Human Resources for the continuity in the Critical Analysis of International Research.



Introduction

The purpose of this article is to design a participatory and solidarity-based management proposal based on the principles of the solidarity economy, which will enable the effective integration of fishing cooperatives in the municipality of Centro, Tabasco, into the processes of operation, administration and distribution of products derived from armoured catfish (*Pterygoplichthys spp.*). This proposal arises in response to a series of structural problems that directly affect the internal cohesion, sustainability and competitiveness of these organisations (Kliksberg, B, 1999).

Firstly, a weak organisational structure is identified, characterised by a lack of clarity in roles, responsibilities and communication channels between members. This fragility limits active participation in decision-making and reduces the sense of belonging and collective commitment. Studies have shown that in public organisations, formal hierarchies and the absence of informal communication networks impair information flows and internal collaboration, creating barriers to participatory processes.

Secondly, there is a lack of participatory management mechanisms structured according to the principles of the social and solidarity economy, such as cooperation, reciprocity and equity. In the absence of these values, internal dynamics tend to become fragmented, individualistic and unsustainable. For example, in the context of social economy enterprises, the principles of reciprocity, solidarity and cooperation are fundamental to sustaining lasting organisational links and avoiding the atomisation of actors (Alfa Publicaciones, 2022). Finally, there is a lack of systematised administrative and operational processes, which leads to disorganisation, inefficiencies and the loss of key information for the technical and productive development of cooperatives.

In view of this context, a comprehensive solution is proposed: the implementation of an armed catfish fillet dryer managed through participation and collaboration. This alternative seeks to strengthen the organisational and operational capacities of cooperatives, improve efficiency in product transformation and generate a positive impact on the socio-economic conditions of cooperative members.

Its added value lies in the fact that it is not limited to the technical aspect of the infrastructure, but incorporates a training and organisational approach focused on internal democracy, co-responsibility and self-management. (Santiago David Muñoz Solórzano, 2022)

The hypothesis guiding this research posits that if cooperatives adopt a participatory management model based on the principles of the solidarity economy, they will be able to successfully implement a catfish drying facility that improves their organisational cohesion, operational efficiency and socio-economic conditions. To test this hypothesis, the article is structured in five sections.

The second section presents the theoretical framework, addressing key concepts such as solidarity economy, participatory management and cooperative structures. The third section analyses the current problems of cooperatives, based on the preliminary diagnosis. The fourth section develops the proposed management model, breaking down its objectives, activities and methodology. Finally, conclusions and recommendations for the practical implementation of the model are presented. This work aims to be an academic and technical contribution to the organisational transformation processes of the Barra Ciega S.C.de R.L.de C.V. fishing cooperative in the municipality of Centro, with a view to more equitable, sustainable and solidarity-based local development. The intention is to replicate it in other cooperatives. The theoretical framework underpinning the research on participatory and solidarity-based management for the implementation of the catfish fillet dryer in fishing cooperatives in the municipality of Centro Tabasco.

Social and Solidarity Economy (SSE) and cooperative identity

The SSE proposes forms of production and governance centred on people and the territory, with cooperation and sustainability. In Latin America, recent studies on the social and solidarity economy emphasise that this model promotes voluntary cooperation, collective action and democratic governance as a basis for strengthening community fabrics and territorial associative projects.

For example, they point out that the SSE focuses on local collective actions, common goods and participatory self-government. In addition, the principles of cooperative identity of the International Cooperative Alliance (ICA), such as democratic member control, economic participation, autonomy and concern for the community, provide an applicable institutional framework for community organisation.

Participatory management and governance of common goods

Participatory management reduces information asymmetries and increases local ownership. In shared resources, Ostrom's theory of the commons provides design principles (defined boundaries, local rules, monitoring, graduated sanctions, conflict resolution and nested arrangements) to sustain self-managed organisations that share common equipment (such as a dryer).

Participatory Action Research (PAR) and collective learning promote cycles of diagnosis-action-reflection with local actors, accelerating the appropriation of processes (filleting and drying) and legitimising organisational and technical adjustments.

Guidelines for small-scale fisheries and value chains.

The FAO recommends an ecosystem approach with community participation in governance and market access, which supports solidarity value chains and the involvement of cooperatives in post-harvest and processing. Safety, quality and standardisation for dried fishery products.

Economic sustainability depends on safety and quality. The Code of Practice for Fish and Fishery Products (FAO/Codex) and the HACCP Guide for Fish (FDA) establish guidelines for drying: temperature/time control, water activity and hygienic practices (2024). In Mexico, regulations for the use of fishery resources are set by the National Commission for Sustainable Fisheries and Aquaculture (CONAPESCA) based on the General Law on Sustainable Fisheries and Aquaculture and the National Fisheries Charter. In this regard, there are no guidelines on the spiny catfish (*Pterygoplichthys pardalis*), as it is an introduced species and fishing is permitted. On the other hand, there is also no federal fisheries management or exploitation plan.

Ecological context of the spiny catfish and productive integration

The armoured catfish (*Pterygoplichthys spp.*), introduced in Mexico, was first recorded in the Balsas River basin, particularly in the El Infiernillo dam (Michoacán-Guerrero), from where its population expanded to other basins in the southeast, affecting local ecosystems and fisheries. Likewise, its integration into value chains—for example, as a source of protein/hydrolysates—allows an ecological liability to be converted into an economic input with potential social and environmental benefits. Alignment with the Sustainable Development Goals (SDGs). The project is aligned with the 2030 Agenda: SDG 8 (decent work), SDG 12 (responsible consumption and production) and SDG 14 (life below water). (UN, 2015)

Development:

Participatory management model: concept and structure

A participatory management model is an organisational framework that encourages the active involvement of different actors in decision-making, planning, implementation and evaluation of actions. It differs from other models in terms of values such as co-responsibility, horizontality, internal democracy, transparency and collective trust. We present the *Tree of Participation* as an inclusive model of participatory decision-making that seeks to empower marginalised groups, promote equity in participation and ensure democratic processes within organisations.

This type of model recognises the knowledge and experience of the organisation's members, valuing their ability to contribute to the achievement of common goals. Thus, not only are technical and administrative processes optimised, but organisational links, a sense of belonging and collective commitment are also strengthened.

Participatory management is particularly relevant in the context of the Social and Solidarity Economy (SSE), where organisations—such as fishing cooperatives—seek not only productive efficiency, but also equity, sustainability, and community well-being.

For this reason, the model proposed in this article is structured taking into account both functional components and criteria of social inclusion and solidarity.

The participatory management model for the implementation of a catfish fillet dryer in the cooperatives of the municipality of Centro, Tabasco, will be based on the following pillars:

The participatory management model for the implementation of a catfish fillet dryer in the cooperatives of the municipality of Centro, Tabasco, will be based on the following pillars:

Participatory organisational diagnosis:

Internal assessment of capacities, processes and organisational culture.

Consultation and validation with key actors:

Involvement of partners, community leaders and institutional actors.

Collaborative formulation:

Design of the model with clear processes, role allocation, communication channels and control mechanisms.

Implementation and shared monitoring:

Implementation of the model with continuous evaluation and feedback from all actors.

The proposed model's approach integrates elements of strategic planning, operational management, human talent management and social sustainability, as observed in the selected reference frameworks.

Comparison of participatory management models

Comparative table of various participatory management models and their relevance in Social and Solidarity Economy (SSE) contexts.

Box 1

Table 1

Comparison of participatory management models

Management model	Central focus	Key components	Social participation	Applicability in ESS
Huertas Tannia et al. (2020)	Based on the interaction between processes, human resources, and technology.	Strategy, execution, organisational culture and horizontal structure.	Recommend involving key stakeholders in the design and implementation.	Media: values participation and strategy, useful if adapted to solidarity principles.
Intriago (2014)	Definition and comprehensive management of eight functional processes within an organisation.	Strategic, operational, human resources, maintenance, financial management, etc.	Limited; focused on internal functional processes.	Low: focuses on operational efficiency rather than solidarity values.
Cabezas (2010)	Participatory process for formulating models with a social, political and organisational focus.	Stages: prospecting, negotiation, formulation and review of the model with key stakeholders.	High participation: social actors, politicians, technical experts, community.	High: includes community participation and multi-stakeholder dialogue.
Mondragón Corporation (2012)	Cooperative model focused on democratic participation, sustainability, and shared responsibility.	Internal democracy, worker participation, collective ownership, solidarity networks.	High participation of members and workers in decision-making.	Very high: designed by and for social and solidarity economy organisations.

Source: Own Elaboration

Methodology

The methodology of this research is oriented towards the design of a participatory and solidarity-based management proposal for the implementation of a catfish fillet dryer in fishing cooperatives in the municipality of Centro, Tabasco. Specifying that the pilot test will be carried out in the Barra Ciega S. C. DE R.L. DE C.V. fishing cooperative. Given the applied and contextual approach, a mixed methodology with a qualitative predominance was chosen, which allows for the integration of both organisational analysis and the active participation of key actors in the design of the model.

Type of study:

The research is part of a descriptive and propositional study, as it aims to characterise the current situation of cooperatives and propose a management model. A participatory and organisational intervention approach is used, typical of the solidarity economy, which recognises the collective experience and situated knowledge of the actors involved.

Research hypothesis:

Hypothesis

If fishing cooperatives adopt a participatory management model based on the principles of the solidarity economy, then they will be able to successfully implement an armoured catfish dryer that improves their organisational cohesion, operational efficiency and socio-economic conditions.

Research variables

Independent variable

Adoption of a participatory management model based on the solidarity economy.

Indicators: level of democratic participation of members, existence of mechanisms for shared responsibility and collective decision-making, practices of cooperation, equity and solidarity.

Dependent variables

- **Organisational cohesion:** clarity of roles and functions, internal communication, level of commitment.
- **Operational efficiency:** proper use of the dryer, production protocols, reduction of losses.
- **Socio-economic conditions:** average income, access to markets, participation of women and young people, perception of community benefits.

Techniques and instruments:

The following techniques were used to meet the specific objectives:

Structured surveys aimed at members and cooperative leaders, in order to identify their experience, participation in productive projects and perception of internal management.

Semi-structured interviews with cooperative leaders, members and the president of the Federation of Fishing, Aquaculture and Permit Holders Cooperatives of Tabasco, S. C. DE R. L. DE C.V., focused on identifying capacities, needs and coordination dynamics.

Direct observation through technical visits to the cooperatives' facilities to gather information on infrastructure, operational processes and working conditions.

SWOT matrices to analyse in a participatory manner the strengths, weaknesses, opportunities and threats faced by cooperatives in the implementation of a fillet dryer.

Universe and sample

The study universe consists of fishing cooperatives registered in the municipality of Centro, Tabasco. A non-probabilistic intentional sample was selected from those cooperatives with an interest and potential to operate catfish processing infrastructure. The units of analysis are the cooperative members, the boards of directors, related institutional actors, and internal organisational and production processes.

Methodological process

The research was carried out in three phases:

1.- Technical-productive organisational diagnosis:

Information gathering through surveys, interviews, and observation.

Assessment of strengths and weaknesses, which we present through the SWOT matrix.

Box 2

Table 2
SWOT MATRIX – Participatory Management for the Armado Catfish Filleting Plant

Strengths (F)	Weaknesses (W)	Opportunities (O)	Threats (A)	FO (F+O) strategies	Directors' and Officers' Liability Insurance
F1. High level of fishing experience (69% >10 years)	D1. Lack of adequate infrastructure (only 7% have a filleting area)	O1. Potential of armoured catfish as a value-added resource (dried fillet)	A1. Price volatility and low profit margins on crude oil	FO1. Implement a filleting plant based on experience and active participation of partners.	DO1. Manage basic equipment: COOLERS, knives, filleting machines. Launch solidarity microloans. stainless steel tables and utensils
F2. High willingness to participate (~90%)	D2. Low awareness of safety standards and standardised processing	O2. Technical training available (27% demand for training)	A2. Health and legal risks of processing at home	FO2. Community technical school on safety and quality in armoured catfish processing	DO2. Establish training pathways with technical support in HACCP and traceability.

F3. Internal democratic governance (minutes, committees)	D3. Lack of standardisation in internal roles and functions	O3. Possibility of institutional partnerships and access to funding	A3. Dependence on individual leadership and lack of succession plans	FO3. Use governance mechanisms to establish framework agreement with purchasers	DO3. Create organisational succession plans and emergency funds with community participation.
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Source: Own Elaboration

2.- Analysis of actors and social relations:

Identify key actors, their interests/capabilities, and map the critical points of the armadillo catfish chain to align agreements, reduce conflicts, and guide cooperation under participatory management.

Identification of key actors.

- a. Cooperatives and fishing bases (presidents, councils, members—women and young people).
- b. Government and regulators: Tabasco State Secretariat of Tourism and Economic Development
- c. Education and research (TecNM/ITVH, UJAT, technology centres, extension workers).
- d. Territorial mapping.
 - Catch areas and landing/collection points.
 - Existing/planned infrastructure: filleting/drying, cold storage, safe water, energy.
 - Transport routes (times/distances) and cold chain nodes.
 - Markets and buyers (local, regional, institutional).
 - Risks: health, flooding, power cuts, pollution.

3.- Design of the management proposal:

Drafting of the model based on the principles of the solidarity economy.

Incorporation of guidelines for participation, equitable distribution and sustainability. This methodology responds to the need to articulate applied research with organisational strengthening from a democratic, inclusive and solidarity-based perspective, which is key to the transformation processes in the cooperative fishing sector.

Results

Organisational and technical-productive diagnosis

a. Governance and transparency

- Presidents: Most reported that there are active councils and committees and that minutes are taken at meetings. Decision-making by majority vote and cooperative principles is promoted.
- Members: Although they recognise the existence of formal structures, some mentioned that decisions are made by a few or that they are not aware of the details of the minutes.
- Conclusion: There is a gap between the formal structure and the experience of internal democracy, which points to the need to strengthen accountability mechanisms.

b. Participation in decisions

- Presidents: They ensure that members have a voice and that co-responsibility is promoted.
- Members: Only 37% indicated that they participate in 'all' or 'most' decisions.
- Conclusion: There is a need to establish real spaces for effective participation, beyond the formality of meetings.

c. Production and infrastructure

- Presidents: Only a minority (7%) reported having adequate spaces for filleting.
- Members: Processing is mainly carried out at home, without sanitary conditions.
- Conclusion: Shared infrastructure, such as collection and processing centres with safety standards, needs to be implemented.

d. Market and prices

- Presidents: They express interest in processing catfish and accessing new markets.
- Partners: They receive low prices for raw fish (\approx £10/kg), and some prefer to discard it due to lack of outlets.
- Conclusion: There is untapped potential in armadillo catfish. The proposal for a dryer could add value and generate more stable marketing channels.

e. Finance and plan management

- Chairpersons: Report quarterly follow-ups to the work plan.
- Members: Some report a lack of communication about progress or results.
- Conclusion: Weaknesses are identified in the feedback of results and transparency in the execution of the plan.

Box 3

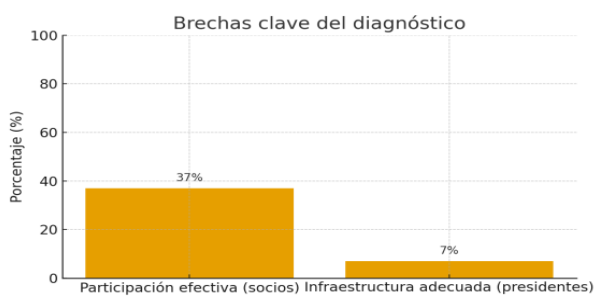


Figure 1

Key gaps in the diagnosis (effective participation and availability of adequate infrastructure).

Source: Own Elaboration

4. Analysis of actors and social relations

- Key actors identified: cooperatives, development institutions (INAES, SEDAFOF), universities (TecNM, UJAT), local merchants, technical partners (FEDECOTAB).
- Mapping and sociogram: Revealed strong alliances between cooperatives and academics, but tensions with private intermediaries and a lack of coordination with health authorities.

- Validation in workshops: Confirmed the importance of creating spaces for inter-institutional coordination and generational renewal.

5. Design of the participatory management proposal

a. Key strategies

- DO2: Design technical training routes for health standards.
- FA1: Establish agreements with buyers to ensure fair prices.
- DA2: Create regulatory compliance pathways with technical support.

b. Proposed model

- Democratic and supportive participation and collaboration.
- Equitable distribution of benefits.
- Participatory monitoring with indicators of cohesion, efficiency, and socioeconomic improvements.
- Active inclusion of women and young people.
- Links with academic and government institutions.

6. Hypothesis validation

Based on the data collected and the analysis, the hypothesis is partially validated:

‘If fishing cooperatives adopt a participatory management model based on the principles of the solidarity economy, then they will be able to successfully implement an armoured catfish dryer that improves their organisational cohesion, operational efficiency and socio-economic conditions.’

Empirical evidence:

- High level of willingness to participate.
- Deficiencies that can be addressed through training, infrastructure, and partnerships.

The empirical results largely confirm this hypothesis. The following variables show significant progress:

- Organisational cohesion: High democratic governance and clarity in collective decision-making.
- Operational efficiency: Willingness to improve infrastructure and establish community processing centres.
- Socio-economic conditions: Identification of collective benefits, inclusion of women and young people, and market potential.

Box 4



Figure 2

Results that verify the research hypothesis

Source: Own elaboration

7. Display of Relevant Results

Below is a comparison between the responses of cooperative presidents and fisher members in relation to governance, participation, infrastructure, market and finance. This comparison allows us to identify gaps, similarities and opportunities to strengthen the participatory model:

Box 5

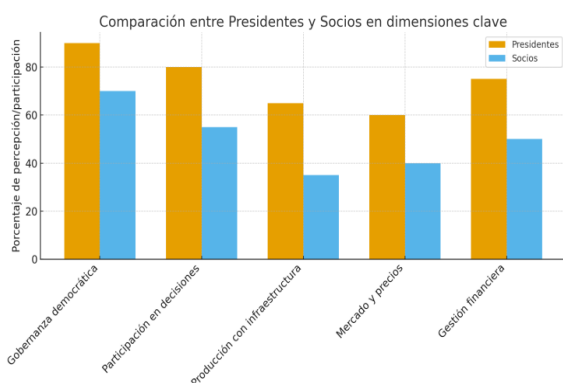


Figure 3

Comparison of perceptions between presidents and cooperative members

Source: Own Elaboration

Conclusions

Collaborative work between cooperatives, educational institutions and public governance, within the framework of the Social and Solidarity Economy (SSE), demonstrated its capacity to promote the sustainable use of armoured catfish in the municipality of Centro, Tabasco. The combination of strategic alliances and training processes strengthened production, value-added processing (e.g., prototypes of dehydrated armadillo catfish fillets for pet treats and meat products) and formal marketing, with positive effects on income, employment and organisational cohesion of cooperatives. Environmentally, productive use contributed to reducing discards and showed signs of containing overpopulation in critical areas.

However, gaps remain between the formal structure and the experience of internal democracy, as well as infrastructure limitations (processing and safety spaces) and information asymmetries in the market and prices. These areas for improvement can be addressed by consolidating participatory governance mechanisms, standardising health processes, enabling collection and processing centres, and strengthening commercial linkages.

Possibilities for improvement (specific actions):

Sanitary standardisation and traceability: implement POE/BPM, batch records and labelling, with technical support.

Commercial linkages: purchase agreements, **collective branding**, local quality seals and stable channels.

Management and marketing: training in **costing**, **price/kg** setting, customer segmentation and contracts.

Socio-environmental monitoring: quarterly indicators (kg used, waste, price/kg, jobs, social perception, discard reports).

Inclusion and governance: targets for the participation of **women and young people** in committees; periodic accountability.

Technological scaling: progress in the **drying plant** and complementary equipment (packaging, refrigeration, storage).

Suggested monitoring indicators (every 3–6 months): kg/months utilised; % wastage; kg of dehydrated fillets; price/kg; number of sales channels; net income per member; number of working days; percentage of attendance at meetings and participation of women and young people.

The implementation of the participatory management model reveals key areas for strengthening within the fishing cooperatives of the municipality of Centro, Tabasco. These include the need to clarify organisational functions, promote horizontal communication and establish formal mechanisms for shared decision-making. The appropriation of the model by community actors is an evolving process that can be optimised through continuous training, deliberative dialogue and structural adjustments.

Economic opportunities and improved implementation of the armoured catfish fillet dryer: The productive use of armoured catfish—a highly available invasive species—represents a strategic opportunity to generate added value and diversify the local economy. The implementation of the fillet dryer, if accompanied by processes of health standardisation, traceability and fair trade chains, can translate into concrete benefits: increased income, job creation and reduced fish waste. Strengthening partnerships between cooperatives, academia and government is key to ensuring its technical, economic and social viability.

Improvements in participatory and collaborative management by fishermen in the fishing communities of Centro, Tabasco: The adoption of a participatory and collaborative approach has begun to transform the internal dynamics of cooperatives by promoting shared responsibility, transparency, collective planning and joint work between different actors. This collaborative nature is essential because it promotes horizontal dialogue, the building of agreements and mutual learning between fishermen, community leaders and partner institutions. While challenges remain—such as the limited participation of women and young people and the lack of access to market information—the model has proven useful in strengthening the sense of belonging, organisational cohesion and collective action.

Its consolidation will depend on shared monitoring processes, constant feedback, and inclusive, adaptive governance based on the active cooperation of all members.

Annexes

Box 6

Table 3

Interview with fishermen from the cooperative

Question	Answer options
In what year was the cooperative formally established?	<input type="checkbox"/> Before 2000 <input type="checkbox"/> Between 2001 and 2010 <input type="checkbox"/> Between 2011 and 2020 <input type="checkbox"/> After 2020
What were the main reasons behind its creation?	<input type="checkbox"/> Financial need <input type="checkbox"/> Fishermen's union <input type="checkbox"/> Access to government programmes <input type="checkbox"/> Other:
Are you familiar with the articles of incorporation and their contents?	<input type="checkbox"/> Yes, everyone knows it <input type="checkbox"/> Some people know it <input type="checkbox"/> No one knows it <input type="checkbox"/> There is no memorandum of association
Do you have official documentation supporting your legal and organisational existence?	<input type="checkbox"/> Yes <input type="checkbox"/> No
How is the cooperative currently organised in terms of its members?	<input type="checkbox"/> Mostly men <input type="checkbox"/> Mostly women <input type="checkbox"/> Balanced
How is the cooperative structured?	<input type="checkbox"/> Board of directors and committees <input type="checkbox"/> Only a chairperson <input type="checkbox"/> No clear structure <input type="checkbox"/> Don't know / No response
Have you defined the roles and responsibilities of each member in writing?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially
Is there an internal operating manual or operational guidelines?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially
Are the roles of chairperson and secretary clearly defined for meetings?	<input type="checkbox"/> Yes, they are well defined <input type="checkbox"/> They are defined, but not applied <input type="checkbox"/> They are not defined <input type="checkbox"/> Not applicable
Where are meetings usually held?	<input type="checkbox"/> Cooperative office <input type="checkbox"/> Member's home <input type="checkbox"/> Public place or community centre <input type="checkbox"/> Other:
Who coordinates or moderates the meetings?	<input type="checkbox"/> Chairperson <input type="checkbox"/> Secretary <input type="checkbox"/> Both <input type="checkbox"/> Other:
What kind of expenses does the cooperative have?	<input type="checkbox"/> Operating expenses <input type="checkbox"/> Administrative expenses <input type="checkbox"/> Both <input type="checkbox"/> I don't know
Who covers those expenses?	<input type="checkbox"/> The cooperative itself <input type="checkbox"/> Each member contributes <input type="checkbox"/> Government or other external support <input type="checkbox"/> Not covered
Do you have a defined role and responsibilities for each member?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Is there an accountant who keeps track of the finances?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If you have a meter, how much does it charge and who pays?	<input type="checkbox"/> No charge <input type="checkbox"/> Monthly fee <input type="checkbox"/> Charge per event <input type="checkbox"/> The cooperative pays <input type="checkbox"/> Another member pays
How often do you hold formal meetings?	<input type="checkbox"/> Once a week <input type="checkbox"/> Once a month <input type="checkbox"/> Every three months <input type="checkbox"/> Only when there are urgent matters
How many members regularly attend meetings?	<input type="checkbox"/> All members <input type="checkbox"/> More than half <input type="checkbox"/> Less than half <input type="checkbox"/> Very few
Who participates most actively in meetings?	<input type="checkbox"/> Men <input type="checkbox"/> Women <input type="checkbox"/> Both equally
Are minutes taken at each meeting recording the decisions made?	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Never

Source: Own elaboration

Box 7**Table 4**

Survey for interview with presidents (cooperatives)

Question	Answer options
How often do you hold formal meetings with the cooperative's members?	<input type="checkbox"/> Weekly <input type="checkbox"/> Fortnightly <input type="checkbox"/> Monthly <input type="checkbox"/> Only when there is an urgent need <input type="checkbox"/> Rarely
What is your role during cooperative meetings?	<input type="checkbox"/> I actively coordinate and moderate <input type="checkbox"/> I only direct the main points <input type="checkbox"/> I delegate leadership to another member <input type="checkbox"/> I do not participate directly in leadership
What strategies do you use to encourage active participation from all members?	<input type="checkbox"/> Use participatory dynamics <input type="checkbox"/> Encourage open dialogue <input type="checkbox"/> Assign speaking turns <input type="checkbox"/> Do not use specific strategies
How do you ensure that decisions are made fairly and impartially?	<input type="checkbox"/> By democratic vote <input type="checkbox"/> By consensus <input type="checkbox"/> I consult with leaders beforehand <input type="checkbox"/> I decide according to my own criteria
What mechanisms do you employ to ensure respect and order during meetings?	<input type="checkbox"/> Clear rules that are enforced <input type="checkbox"/> Verbal warnings <input type="checkbox"/> Support from the secretary or spokesperson <input type="checkbox"/> No formal mechanism
Do you personally inform members about the agreements reached?	<input type="checkbox"/> Yes, at the end of each meeting <input type="checkbox"/> Through shared minutes <input type="checkbox"/> Verbally at the next meeting <input type="checkbox"/> Not always formally reported
How do you ensure that relevant information reaches all members of the cooperative?	<input type="checkbox"/> Through printed or digital minutes <input type="checkbox"/> Through the internal communication group <input type="checkbox"/> Through informational meetings <input type="checkbox"/> No defined means
Are the documents and minutes available to all members who request them?	<input type="checkbox"/> Yes, at all times <input type="checkbox"/> Only with authorisation <input type="checkbox"/> Depends on the type of document <input type="checkbox"/> Access is not permitted
Do you consider that you fulfil all the duties assigned to you in accordance with the cooperative's internal regulations?	<input type="checkbox"/> Yes, completely <input type="checkbox"/> Mostly <input type="checkbox"/> Only the main functions <input type="checkbox"/> I am still unfamiliar with some functions
What steps do you take to ensure that the annual work plan is fulfilled?	<input type="checkbox"/> I monitor progress continuously <input type="checkbox"/> I review progress every quarter <input type="checkbox"/> I leave that task to someone else <input type="checkbox"/> There is no defined annual plan
How do you follow up on the agreements reached in the sessions?	<input type="checkbox"/> I monitor compliance <input type="checkbox"/> I only check for complaints <input type="checkbox"/> It is the secretary's job <input type="checkbox"/> There is no systematic follow-up
How do you represent the cooperative before external institutions?	<input type="checkbox"/> Through negotiations and meetings <input type="checkbox"/> Only when there are official calls for proposals <input type="checkbox"/> Another member performs this task <input type="checkbox"/> We have not had external representation
Have you promoted alliances with other cooperatives or institutions?	<input type="checkbox"/> Yes, with positive results <input type="checkbox"/> I have tried, but without success <input type="checkbox"/> I do not consider it a priority <input type="checkbox"/> I have not done so

Source: Own elaboration

Disclosures**Conflict of interest**

The authors declare that they have no conflicts of interest. They have no known competing financial interests or personal relationships that could have influenced the article reported in this paper.

Contribution of the authors

Rivera-Rodríguez, Maria: Identification of information sources, data classification, document structure.

Sepúlveda-Quiroz, Cesar Antonio: Support for fishing and aquaculture information. Field visits, interviews and surveys of fishermen.

Hernández-Martínez, Maria del Carmen: Development of the quantitative research instrument, application of the research instrument to fishermen from the Barra Ciega cooperative in the central municipality. She also contributed to the analysis of the data and results.

Karina-González Izquierdo: Application of the research instrument, logbook, analysis of results.

Availability of data and materials

All data used for the analysis and development of the article are available from the corresponding author upon request.

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Abbreviations

ACI/ICA	Alianza Cooperativa Internacional / International Cooperative Alliance.
BPM	Good Manufacturing Practices.
Codex	Codex Alimentarius (FAO/WHO code/guidelines).
ESS	Social and Solidarity Economy.
FAO	Food and Agriculture Organisation.
SWOT	Strengths, Weaknesses, Opportunities, Threats
FDA	Food and Drug Administration (USA).
HACCP	Hazard Analysis and Critical Control Points.
IAP	Participatory Action Research.
NODESS	Nodes for the Promotion of the Social and Solidarity Economy.
SDGs	Sustainable Development Goals.
UN	United Nations
SOPs	Standard Operating Procedures.

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