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# Institutional arrangements in the promotion of sustainable livestock: an approach from the case of beef and dairy cattle production chains in Jalisco, Chiapas, and Campeche

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This study focuses on a policy and practice review of existing institutional arrangements within the beef and dairy cattle production sectors in the Mexican states of Jalisco, Chiapas, and Campeche. Acknowledging the critical role of robust governance frameworks in transitioning towards sustainable livestock agriculture, a collaborative governance approach is employed to holistically address environmental and production challenges. This approach underscores the importance of active participation, stakeholder collaboration, and contextual adaptation in decision-making processes. Classified as explanatory research, the study is grounded in a qualitative approach, covering a synchronous period from 2017 to 2022. Secondary sources such as public policies, international climate commitment reports, sector-specific reports, and databases were utilized to provide context and data regarding the analyzed institutional arrangements. Additionally, semi-structured information-gathering protocols were developed and, in conjunction with participant observation, administered to approximately 30 key stakeholders from public, private, academic, research centers, international cooperation, and civil society sectors involved in institutional arrangements in the aforementioned states. The findings highlight the significance of collaborative governance as a valuable alternative for addressing governance challenges in the livestock sector, particularly when hierarchical or market-oriented approaches are less effective. The diversity of identified institutional arrangements, ranging from hierarchical to polyarchic, emphasizes the need to acknowledge the specificities of the context in which they operate and adapt strategies accordingly. This analysis contributes to the growing discussion on sustainable livestock farming and the fundamental role of institutional arrangements in promoting responsible practices and mitigating environmental impacts. As demands for natural resources and environmental awareness increase, understanding and strengthening these arrangements become essential to balance livestock production and environmental conservation.

## KEYWORDS

livestock sustainability, institutional arrangements, collaborative governance, public policies, stakeholder engagement

# 1 Introduction and problem statement

## 1.1 General context

Livestock farming plays a crucial role in the global economy and food security. It is a significant source of protein and essential nutrients worldwide, and a key economic activity for millions of people. In Mexico, livestock farming is not only a critical economic activity but also an integral part of culture and rural life. As reported by the [Government of Mexico \(2023b\)](#), livestock contributes substantially to the nation's GDP (Gross Domestic Product), particularly in the primary sector (39,7%). Mexico stands as a major global player in the production of animal-origin meat protein and bovine milk, ranking seventh and fifteenth worldwide, respectively ([Government of Mexico, 2023a](#)).

At the national level, beef cattle farming is the primary source of animal protein, accounting for 82.1% of animal-origin food ([IICA, 2021](#)). This sector occupies 56% of Mexico's land area, equivalent to 1.1 million square kilometers ([IICA, 2021](#); [Vásquez Aguilar, 2023](#)), highlighting its extensive economic and environmental footprint. However, the expansion of livestock farming has led to ecological challenges, including habitat degradation and fragmentation, particularly in 24 states of the country since 2002 ([Vásquez Aguilar, 2023](#)).

Conventional livestock farming practices have been associated with various negative impacts, such as deforestation, biodiversity depletion, water pollution, and significant greenhouse gas emissions (GHG). Notably, these GHG emissions account for 68% of the total emissions within the agricultural sector ([IICA, 2021](#)). In response to these challenges, sustainable livestock farming has emerged as a pivotal approach. This approach aims to reconcile livestock production with environmental conservation, animal and human health, local economic dynamism, and social well-being. It focuses on improving productive efficiency, minimizing negative environmental impacts, promoting animal welfare, ensuring equity in production chains, and fostering local stakeholder participation in decision-making processes.

The transition towards sustainable livestock farming necessitates solid institutional arrangements that actively support these changes. Defined as "patterns of relationships among multiple institutions in a specific context" ([Ostrom, 2014](#)) these arrangements are crucial in defining incentives, responsibilities, and interactions not only among various stakeholders within the production chains but also between producers, consumers, the private sector, governmental and non-governmental organizations, and research institutions. As tangible outcomes of governance frameworks, institutional arrangements play a pivotal role in influencing relational dynamics, resource allocation, and conflict resolution, thereby facilitating the shift towards more sustainable practices in livestock farming.

## 1.2 Works related

Over the past decade, there has been a marked increase in research into the role of governance in the agricultural sector. These studies stem from global efforts to understand and improve resource management and policy-making for sustainable agricultural development. They have evolved from centralized state management models to more participative and decentralized methods involving a wide range of actors, including the private sector, civil society, and local communities.

A key precursor to this research is found in environmental governance studies, particularly in forestry and water domains, which have a rich historical record. Internationally, the contributions of Elinor Ostrom's groundbreaking work in the governance of common-pool resources, such as forests and water, has received international recognition ([Ostrom, 1990, 2010a](#); [Poteete et al., 2010](#)). Arlin Vatn, known for his contributions in institutional economics and environmental governance, is also noteworthy ([Vatn, 2005, 2020](#); [Aasen and Vatn, 2021](#)). Brendan Coolsaet's focus on environmental justice and biodiversity governance has been influential ([Alvarez and Coolsaet, 2020](#); [Coolsaet et al., 2020](#)), along with Thomas Sikor's expertise in land governance and forest resources ([Sikor, 2008, 2013](#)), and Anne Larson's significant research on forest governance and indigenous rights ([Larson and Petkova, 2011](#); [Petkova et al., 2011](#)).

In Latin America, Eduardo Brondizio is distinguished for integrating anthropology with environmental sustainability ([Tengo et al., 2014](#); [Brondizio and Le Tourneau, 2016](#); [Chazdon et al., 2021](#)). The works of Cristiana Simão and Déborah Santos in natural resource management and environmental governance ([Santos et al., 2021, 2022](#)) and María Tengö's focus on socio-ecological system governance emphasizing indigenous and local knowledge ([Enqvist et al., 2020](#); [Tengö et al., 2022](#)) are equally important.

Agricultural governance, on the other hand, has become a relevant field of study in response to the region's particular challenges: inequality in land tenure, the critical role of agriculture in local economies, and the urgency of conserving biodiversity amidst agricultural expansion. Research has grown concerning how institutional frameworks and policies can support economically efficient, socially equitable, and environmentally responsible agricultural practices. From an agroecological perspective ([Altieri et al., 2020](#); [Altieri and Nicholls, 2020](#)), focusing on data use to support the decision-making process ([Li et al., 2023](#)) and based on knowledge management ([FONTAGRO, 2019](#)), these contributions have been pivotal, mainly centered on the need for collaborative work, access to information, and co-design and co-participation in decision-making processes.

Overall, research has increased in recent years around how institutional frameworks and policies can support agricultural practices that are economically efficient, socially fair, and environmentally responsible. This aligns with the fact that governance in the Latin American agricultural sector has become more complex, recognizing the need for multidisciplinary and multi-level approaches that address interactions between policies at local, national, and international levels.

There are also significant contributions to the field, such as efforts to document the political-institutional conditions that recreate certain governance schemes for the cases of the three Mexican states analyzed in this article ([Avalos, 2023a,b,c](#)) as well as for Costa Rica ([Avalos and Chacon, 2023](#); [Avalos, 2023a](#)).

Despite the significant advances demonstrated by such studies, having a typology that allows mapping institutional arrangements within the framework of productive chains to dissect the governance scheme as a whole has been a pending task. Theoretical contributions by Elinor Ostrom ([Ostrom, 1990, 2010a,b](#); [Poteete et al., 2010](#)) and [Ansell and Gash \(2007\)](#) have allowed this study to go further, offering a typology of institutional arrangements that encompass a particular governance scheme, as woven around the productive chains of meat and milk in the states of Chiapas, Jalisco, and Campeche.

### 1.3 Paving the path for sustainability: the contributions of this study

This article, set within the backdrop of the “Promoting Biodiversity Conservation through Climate-Smart Agro-silvopastoral Practices in Livestock-Dominated Landscapes” project,<sup>1</sup> embarks on a critical examination of institutional arrangements pivotal for sustainable livestock farming. The contributions are manifold:

- Unveiling institutional dynamics: this study uncovers various institutional arrangements, from hierarchical to polyarchic, each adapted to local contexts. This provides a governance blueprint that respects regional differences.
- Promoting collaborative governance: it underscores the essence of collaborative governance. The diversity in institutional arrangements elucidates the need for strategies acknowledging local context nuances, thus enhancing decision-making quality, transparency, and accountability.
- Guiding future research: this work paves the way for comparative analyses across different regions, deepening the understanding of how institutional frameworks evolve and adapt, and evaluating stakeholders’ perceptions to glean insights into the operational challenges and opportunities.

### 1.4 Methodology

To elevate the methodological rigor of this study, a comprehensive and multi-dimensional approach is adopted, which integrates both qualitative and quantitative data for a thorough mapping of production chain structures. Emphasizing an explanatory stance, the research systematically explores the evolution of institutional arrangements within a governance framework. This blended methodology facilitates a nuanced analysis of developments, challenges, and future prospects in the livestock sector with enhanced precision, covering the period from 2017 to 2022.

Incorporating a neo-institutional perspective, this research method analyzes governance structures in depth. This approach is augmented by a sustainable value chain analysis, focusing on the economic, environmental, and social impacts within the livestock industry. Such a dual-method strategy ensures a comprehensive examination of institutional arrangements, capturing the intricate dynamics and complexities of sustainable agricultural practices.

Key components of this methodology include:

- A neo-institutionalist perspective that emphasizes collaboration and cooperation, as proposed by Ansell and Gash. This viewpoint considers the complexity of value chains, their interdependence

with other economic sectors, and the inherent relational and power dynamics (Ansell and Gash, 2007).

- The sustainable value chain approach, which identifies critical stages, value flows, and stakeholder relationships, aims to deliver products or services to differentiated markets, ensuring equitable distribution of benefits.
- An exploration of institutional arrangements, defined as “patterns of relationships among multiple institutions within a specific context” (Ostrom, 2014). This includes norms, rules, organizational structures, and public policies that govern interactions and decision-making processes relevant to resource allocation and conflict resolution.

Through this integrated methodological framework, the study achieves a rigorous and holistic understanding of the factors influencing sustainable livestock farming.

Secondary sources such as public policies, international climate commitment reports, sector-specific reports, and data bases were utilized to provide context for the livestock sector and data regarding the analyzed institutional arrangements. Subsequently, semi-structured information-gathering protocols were developed, and in conjunction with participant observation, were administered to approximately 30 key stakeholders from the public, private, academic, research centers, international cooperation, and civil society sectors involved in institutional arrangements in the states of Jalisco, Chiapas, and Campeche.

For the purposes of this article, institutional arrangements have been analyzed using a typology that distinguishes between hierarchical, market-based, community-based, and polyarchic arrangements, built upon the contributions of Ansell and Gash (2007) and Ostrom (2014).

Regarding data analysis, a qualitative approach was employed, which relied on the analysis of interview results to identify emerging patterns and themes grounded in theory.

### 1.5 Structuring the narrative: organization of the article

The structure of this article is thoughtfully designed to guide readers through the intricacies of sustainable livestock farming within the complex fabric of institutional arrangements:

- Introduction and problem statement: the article opens by setting the scene on the challenges and objectives of sustainable livestock farming.
- Methodological approach: a qualitative lens is applied to dissect the workings of various institutional arrangements, providing a comprehensive view that informs the study’s findings.
- Findings and discussions: the core of the article lies in its detailed analysis of these arrangements, their effectiveness, and their influence on sustainable practices within the livestock sector.
- Conclusions and recommendations: the narrative culminates with actionable insights and recommendations, charting a course for future initiatives and policy-making to foster sustainable livestock farming practices.

Each section builds upon the previous, ensuring a coherent and informative journey for the reader, ultimately leading to a set

<sup>1</sup> BioPaSOS, an acronym for ‘Biodiversity and Sustainable Agro-silvopastoral Landscapes’, was an initiative active from 2017 to 2022. It aimed primarily at empowering livestock producers through the adoption of sustainable agro-silvopastoral practices. The project’s core mission was to mitigate the adverse effects on biodiversity inherent in traditional livestock farming, encourage decisions grounded in robust scientific evidence, and foster a collaborative approach in the management of value chains (CATIE, 2023).

of well-founded conclusions and recommendations that promise to shape future discourse and action in the realm of sustainable livestock farming.

## 2 Sections on assessment of policy/guidelines options and implications

In this section, a detailed evaluation of the institutional arrangements related to the promotion of sustainable livestock farming in the states of Jalisco, Chiapas, and Campeche is provided. As outlined, these arrangements are categorized into hierarchical, market-based, community-based, and polyarchic types. This typology, informed by the contributions of *Ansell and Gash (2007)* and *Ostrom (2014)* offers a structured framework for the analysis, as visually represented in the accompanying diagram.

The subsequent section delves into the specifics of these arrangements, exploring each category in detail. An in-depth understanding of these types is essential for comprehending the broader context of sustainable livestock farming within the studied regions, highlighting how these arrangements influence practices and policies. The analysis methodically examines the implications of these arrangements, providing insights into their effectiveness and areas for potential improvement.

## 3 Hierarchical institutional arrangements

Within this study, three sub-types of hierarchical institutional arrangements have been identified:

### 3.1 Regulations and norms imposed by authorities

In all three analyzed states, the existence of federal and state government regulations and norms that establish requirements and procedures for livestock production is observed. In many cases, these regulations also emphasize environmental conservation within the context of production practices.

### 3.2 State-level supervisory and regulatory bodies

The oversight and regulation of livestock activity are carried out by key state institutions (see *Figure 1*). In each of the reference states, organizations with defined roles have been established to ensure compliance with regulations and norms related to livestock production.

Traditionally this role had been within the purview of the State Departments of Agriculture, over time, a closer alignment between production-focused supervision and environmental oversight has been observed. This has allowed for the identification of governmental entities linked to the Departments of Environment in this exercise. Additionally, state-level instances, at the federal level, are involved in this role of supervision and regulation (see *Figures 2–6*).

### 3.3 State and/or federal support programs with hierarchical conditions

Finally, concerning state or federal support programs with hierarchical conditions, various initiatives have been identified as the first element demonstrating the presence of institutional arrangements of this type (see *Table 1*).

As a second element, in all states, the role of “Operating Rules” can be observed, which constitute a set of guidelines and directives established by government agencies, both at the federal and state levels, to regulate and guide the implementation of public programs and policies in different areas. These rules define the procedures, requirements, eligibility criteria, and operational methods of government programs and projects.

Operating rules constitute requirements for the use of certain programs; therefore, they can be considered hierarchical in nature, as they are designed with the purpose of ensuring the proper execution of public resources, transparency in their use, and the efficient delivery of benefits to citizens or target groups who are recipients of these programs. These rules provide a legal and operational framework that must be followed to request, access, and utilize resources and support provided by the government in various areas, such as agriculture, livestock, and the environment.

These programs exemplify how state and federal authorities have established requirements and conditions for providing support to livestock producers, with the aim of promoting more responsible and sustainable practices.

Finally, it is possible to identify that, for the State of Jalisco, there are programs focused on the provision and regulation of ecosystem services, which are operated with state funds. These programs aim to compensate agricultural producers for practices that generate environmental benefits, such as the conservation of natural areas, the protection of water sources, or the reduction of greenhouse gas emissions. These state-implemented programs incentivize agricultural producers to adopt sustainable livestock practices. In this regard, the programs available in the state are as follows: Sustainable Forest Development Program of the State of Jalisco 2023 (Component IV). Component I: Sustainable Forest Management (SFM). Component II: Compensation for Environmental Services (CES). Component III: Afforestation for Silvo pastoral Systems (ASS). Component IV: Forest Carbon Projects (FCP). Component V: Forest Protection with Health Actions (FPH).

For the State of Chiapas, no programs supporting livestock producers with state funds for the provision and regulation of ecosystem services have been identified. However, on some occasions, the State Government has developed subsidy programs for the acquisition of breeding stock.

In Campeche, six support programs have been identified to benefit livestock producers, including the following: the Electric Fence Implementation Program, aimed at intensifying pasture management for better utilization of grazing resources for livestock feed; the Implementation of Preventive Actions Program in Livestock Production Units against the Effects of Drought, with its main objective being to support producers with animal supplementation during critical times of the year; the Equipment Implementation Program for Increased Dairy Production, which seeks to support producers with technologically advanced milking



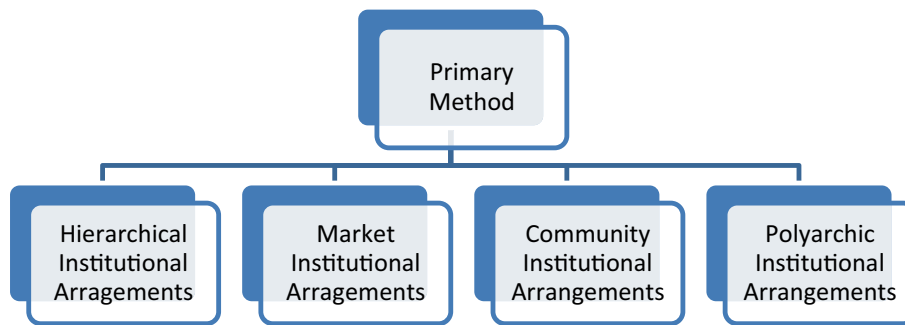


FIGURE 1  
Structural diagram of the primary method and its subsections.

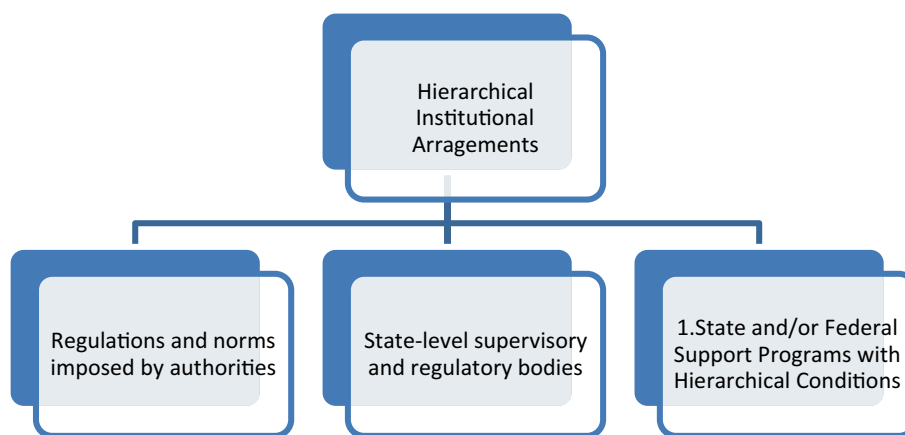


FIGURE 2  
Subtypes of hierarchical institutional arrangements.

equipment; the Bovine Herd Productivity Increase Program, aimed at improving and increasing livestock herds through artificial insemination techniques; and the Breeding Stock Acquisition Subsidy Program. Additionally, there is an Extension Program for Agricultural Development.

## 4 Institutional market arrangements

To provide a structured understanding of the market dynamics within Jalisco, Chiapas, and Campeche, our analysis delineated five distinct subtypes of institutional market arrangements. This classification emerged from a systematic examination of the data, guided by our research objectives, and informed by the theoretical framework established in our methods section.

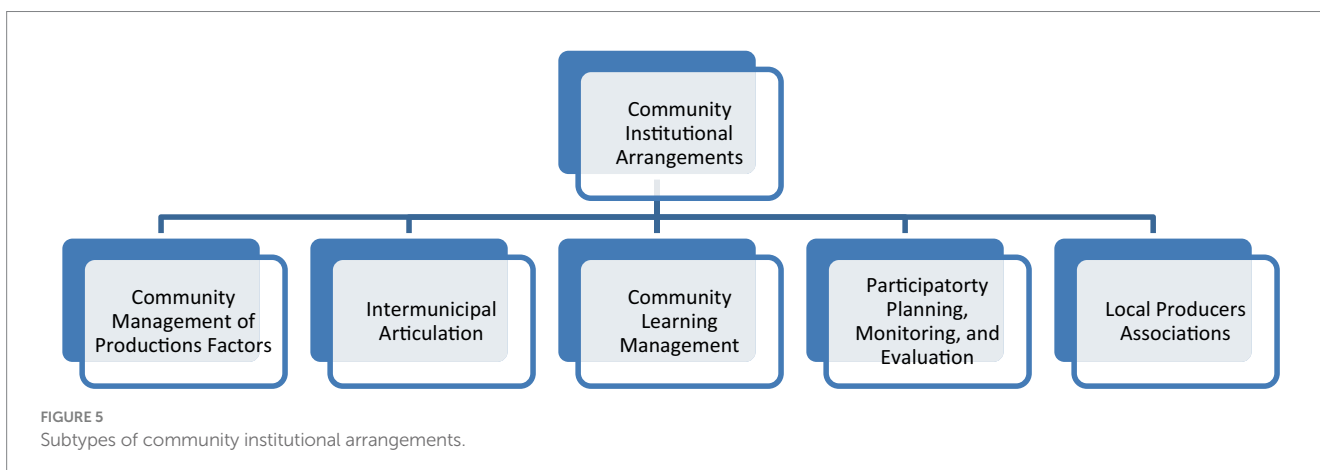
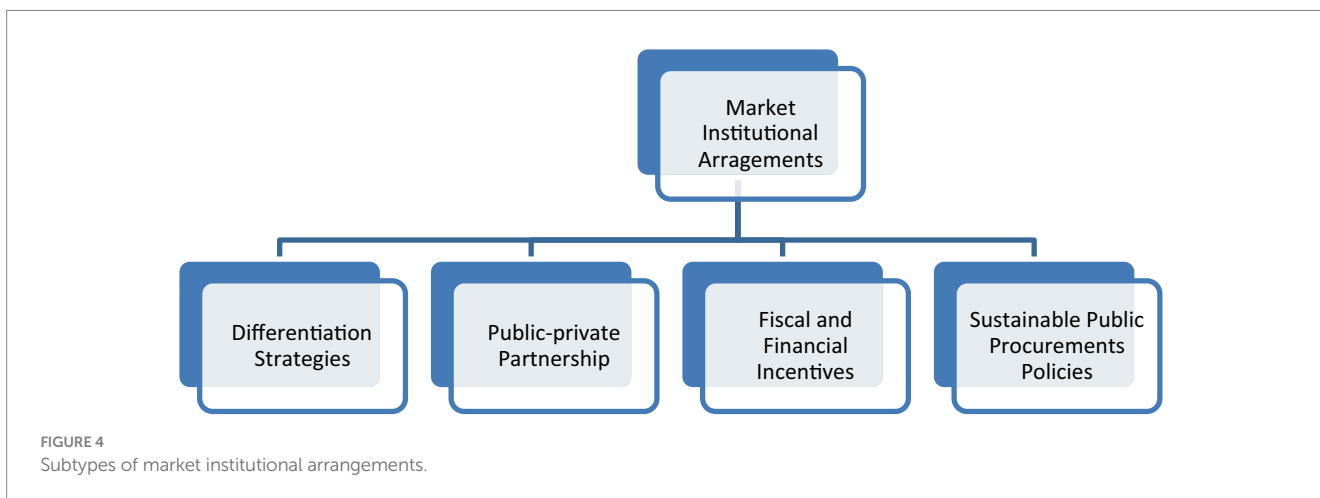
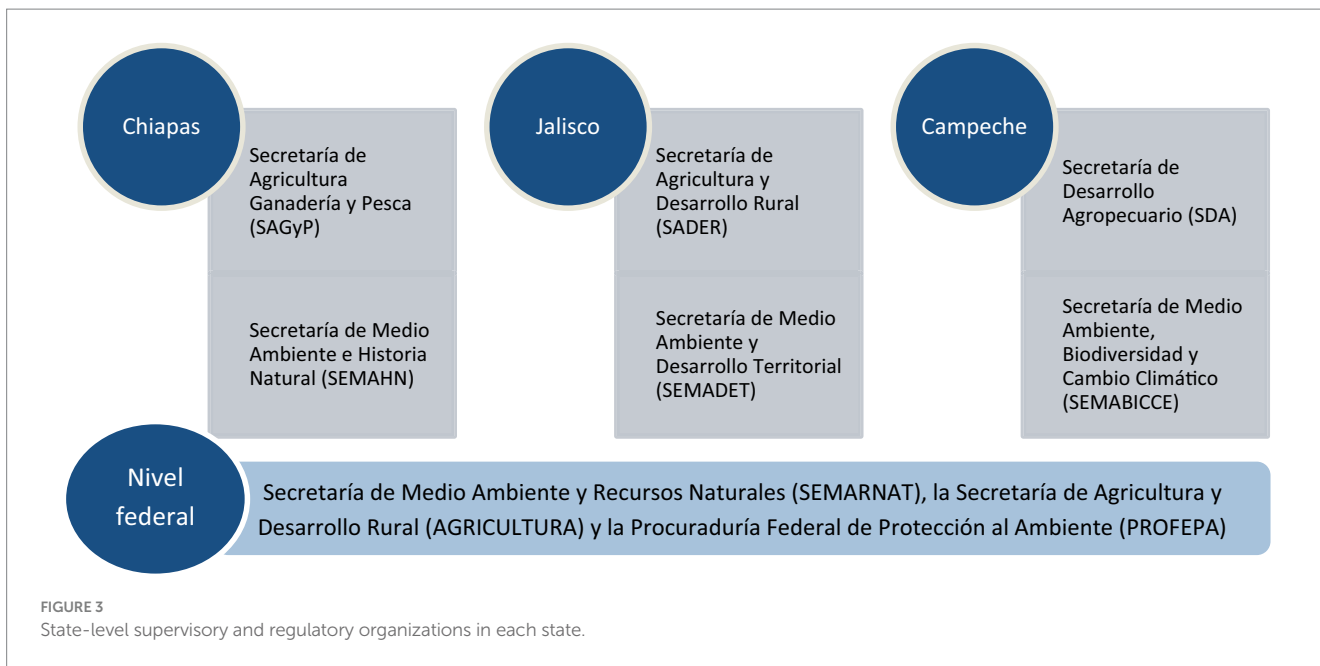
### 4.1 Differentiation strategies

In our results, differentiation has been meticulously analyzed, considering multiple facets such as pricing strategies, the impact of certifications, the role of quality seals, and the effectiveness of various marketing channels. This comprehensive analysis allows for a nuanced

understanding of market dynamics and their influence on sustainable livestock farming.

In Chiapas, there is a clear interest on the part of entities such as SAGyP and SEMAHN (Secretaría de Medio Ambiente e Historia Natural), as well as non-governmental institutions, to promote the differentiation of prices for sustainable livestock products. Furthermore, efforts are underway to develop seals that allow for the differentiation of livestock products that meet environmental standards, incentivizing producers to adopt sustainable practices. Despite these advances, there is still a pending task to work on specific strategies, such as labeling and traceability that would enable consumers to know the origin and production practices of livestock products. This would facilitate the selection of products coming from sustainable production systems, promoting the demand for sustainability-focused livestock.

In Jalisco, the differentiation process has been initiated through the “Deforestation-Free Pasture-Based Beef Initiative,” promoted by the Northeast and West Fund Civil Association (FONNOR A.C.), currently undergoing the implementation phase and is anticipated to commence operations before the conclusion of 2023. This innovative production and marketing model aims to promote sustainable livestock through price differentiation, the presence of a seal, proper label management, and ensuring product traceability.



Finally, in Campeche, it has not been possible to identify specific institutional market arrangements focused on product differentiation from the aspects described above.

## 4.2 Public-private partnerships

It can promote sustainable livestock through joint agreements and programs. These partnerships may involve governments, businesses, producer organizations, and other relevant stakeholders, enabling the implementation of strategies that promote sustainable practices in the livestock value chain. Such partnerships have naturally evolved in the three states through multi-stakeholder coordination spaces, public-private initiatives, or research efforts with academia aimed at

combining efforts and synergies to address common sectoral challenges and transition toward sustainable schemes.

## 4.3 Fiscal and financial incentives

To promote the adoption of sustainable practices in livestock. These institutional arrangements may include tax exemptions for livestock products from sustainable systems, preferential loans, or subsidies for investments in more sustainable infrastructure and technologies. In the case under examination, it was only possible to identify the Sustainable Projects Support Program (ProSostenible) granted by the Trusts Established in Relation to Agriculture (FIRA). This program aims to facilitate access to credit for investment projects in the agricultural sector that generate environmental benefits and/or improve the capacity for climate change mitigation and adaptation. This program is present throughout the country, with small and medium-sized producers as its primary target population.

## 4.4 Sustainable public procurement policies

It establishes sustainability criteria in the acquisition of livestock products by government entities, promoting the demand for livestock products from sustainable systems. They can have a significant impact as major buyers in the market. Like the previous case, it has not been possible to identify institutional arrangements in this area in the three states under study.

This highlights the accomplishments of the states concerning these institutional arrangements. However, it is not solely the hierarchical role of the state and market relationships that shape these institutional setups.

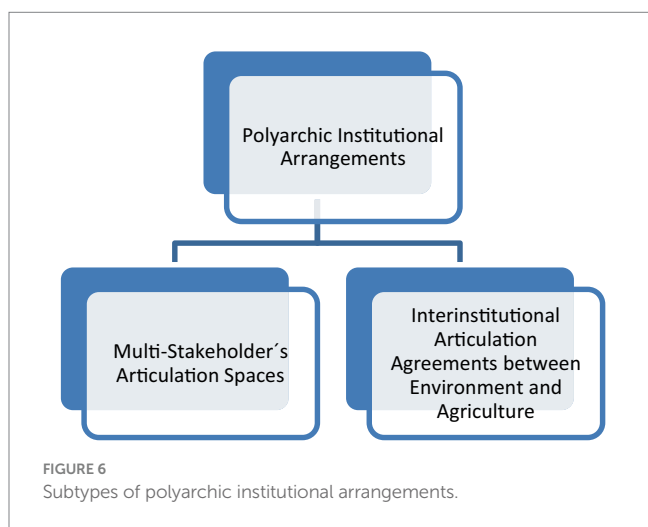


TABLE 1 State and/or federal support programs with hierarchical conditions.

State	Program	Objective
Chiapas	Subsidy program for the acquisition of breeding stock	Providing support to livestock producers through the provision of breeding stock for genetic enhancement in livestock herd productivity.
Campeche	Electric fence implementation program:	Enhancing pasture management to achieve improved utilization of grazing resources for livestock feed.
	Preventive actions program in livestock production units against the effects of drought	Supporting producers with animal supplementation (molasses, silage, and hay) during periods of drought
	Implementation of equipment program for increased dairy production:	Support for milking equipment and training for small and medium-sized producers.
	Program for increasing bovine herd productivity	Supporting small and medium-sized producers through artificial insemination schemes.”
	Breeding stock acquisition subsidy program	Providing support to livestock producers through the provision of breeding stock to enhance genetic improvement in the productivity of the cattle herd.
	Extension program for agricultural development	Supporting producers with technical assistance and training.
Jalisco	Field action program for climate change	Designed to address climate challenges in livestock farming.
	Young heirs of the field support program	Targeted at young individuals involved in livestock farming and inheritors of rural traditions.
	Program for the Promotion of agricultural production and modernization	It aims to enhance productivity and modernization in the livestock sector.
	Program for genetic improvement of cattle, sheep, and goats	Focused on the genetic enhancement of livestock to increase quality and yield.
	Sustainable forestry development of the state of Jalisco (FIPRODEFO):	Aimed at the sustainable development of forest resources.

The following offers a reflection on what is referred to as ‘community arrangements,’ further enhancing the perspective of this typology.

## 5 Community institutional arrangements

Community institutional arrangements encompass an approach where the local community plays a vital role in decision-making and the management of natural resources and collective interests. These arrangements are based on active participation by community members who collaborate in creating norms and governance mechanisms that regulate the use and conservation of resources.

Within these arrangements, the community shares the responsibility for collectively managing resources, seeking mutual benefits. Decision-making processes are inclusive and participatory, granting a voice and vote to all members in relevant matters. This collaboration fosters cooperation and mutual trust, contributing to the effectiveness and sustainability of the agreements reached.

There are countless examples of community institutional arrangements that vary depending on culture, context, and the specific needs of each community. However, they all share the characteristic of promoting collaboration and empowering community members in decision-making and the management of shared resources. During the analysis conducted in Jalisco, Chiapas, and Campeche, five subtypes of these arrangements were identified:

### 5.1 Community management of production factors

This encompasses the administration of communal lands and ecosystem services. For example, in Jalisco, community land management is seen in indigenous areas, as well as the management of ecosystem services by *ejidos*<sup>2</sup> in the three states studied. In Chiapas, there are initiatives for the joint management of natural resources.

### 5.2 Intermunicipal articulation

This concept stands out for its innovation in territorial resource management in the state of Jalisco. In this state, 11 cross-municipal boards have consolidated experiences in intermunicipality,<sup>3</sup>

<sup>2</sup> In Mexico, an “ejido” is a type of communal agricultural unit that was established as part of the agrarian reform in the early 20th century. Ejidos are communal lands distributed among the members of a community or village, and land ownership is not individual but belongs to the community as a whole. Ejidos were created with the aim of promoting land redistribution and agrarian justice, providing access to land for those who historically did not have it.

<sup>3</sup> In Mexico, “intermunicipality” refers to the collaboration and cooperation among municipalities or local governments to address issues or matters of common interest that transcend the administrative boundaries of a single municipality. This entails multiple municipalities working together in the planning and execution of projects, programs, or policies that have a regional impact or require a broader coordination than what an individual municipality could provide.

illustrating how the intersection between environmental protection and sustainable livestock production is addressed at the community level.

### 5.3 Community learning management

Projects such as model ranches, experimental farms, and field schools (ECA) facilitate the transfer of knowledge and technologies toward more sustainable production practices. Through the BioPaSOS Project, these entities were established in the three states, influencing other communities. In Jalisco, intermunicipal boards and SADER have also promoted these spaces for community learning management, even extending technical assistance to other productive sectors.

### 5.4 Participatory planning, monitoring, and evaluation

In Jalisco, a participatory Regional Territorial Planning program has been implemented, addressing livestock-related issues. Additionally, within national protected areas and certain ejidos in Chiapas, participatory monitoring and evaluation processes are carried out.

### 5.5 Local producer associations

These associations are present in all three states, enabling collaboration among producers at the local level.

Community institutional arrangements focus on promoting the participation of local communities in decision-making processes and the management of shared resources. In Jalisco, Chiapas, and Campeche, various forms of community collaboration were identified, ranging from the management of production factors to participatory planning and producer associations. The significance of involving communities in the pursuit of sustainable solutions is reflected in these approaches. After concluding this section, we will delve into the study of polyarchic institutional arrangements.

## 6 Polyarchic institutional arrangements

Polyarchic institutional arrangements represent a governance approach that promotes participation and shared decision-making among diverse stakeholders, such as government, the private sector, civil society, academia, and local communities. These arrangements seek to strengthen collaboration and shared responsibility in problem-solving and resource management.

In polyarchic institutional arrangements, it is acknowledged that multiple stakeholders possess diverse interests and knowledge that can contribute more effectively to governance. The goal is to prevent the concentration of power in a single stakeholder or group, promoting inclusivity and equitable participation in decision-making.

These institutional arrangements are grounded in the premise that effective governance involves collaboration and cooperation among diverse stakeholders. The aim is to establish spaces for dialogue and



negotiation where stakeholders can exchange information, share perspectives, and make joint decisions.

In the study conducted in Jalisco, Chiapas, and Campeche, two specific subtypes were identified within this group of institutional arrangements:

## 6.1 Multi-stakeholder's articulation spaces (collectives/dialogue platforms)

These spaces bring together diverse stakeholders for dialogue and collaboration on specific issues. An example is the Sustainable Livestock Group in Chiapas, the Silvo pastoral Operational Group in Jalisco, and the Working Group on Sustainable Livestock Agroecosystems (AGS.CAM). These spaces have also attempted to promote participatory research agendas among academics, researchers, and the public sector. However, sustainable long-term proposals have not yet been consolidated.

## 6.2 Interinstitutional articulation agreements between environment and agriculture

This approach refers to the strong relationship between the Environmental and Agricultural Secretariats. In Jalisco and Chiapas, this relationship unfolds smoothly. In Campeche, the relationship is more technical and focused on specific issues. This collaboration aims to coordinate efforts between different government entities to address challenges at the interface between agriculture and the environment.

This research highlights the role of collaborative governance in sustainable livestock farming. It emphasizes the need for context-specific strategies in diverse institutional arrangements. Concluding this section, we will explore a general discussion of these findings.

## 7 Discussion

The investigation of institutional arrangements across the beef and dairy production chains in Jalisco, Chiapas, and Campeche has unveiled the dynamic forces shaping sustainable livestock farming. The discussion herein is grounded in a rigorous assessment of these arrangements, ranging from hierarchical to polyarchic, and decisively underscores their role in resource management and environmental stewardship within the sector. A meticulous analysis of the collected data reveals clear links between the structure of these arrangements and their operational outcomes, casting light on the pathways to sustainable livestock management.

While hierarchical arrangements have streamlined sustainable practices and adherence to regulations, they have also surfaced challenges, notably in stakeholder inclusion and empowerment. Centralized decision-making may disenfranchise local stakeholders, potentially engendering resistance and undermining the legitimacy of initiatives. Addressing the nuances of stakeholder engagement is critical, with a focus on enhancing local input and enabling change from the grassroots level.

Concurrently, the challenge lies in fostering inter-institutional collaboration and transparent responsibility sharing, critical for the

efficacious application of regulations and standards. The discourse contemplates the ramifications of these arrangements, probing into how they can be reformed to facilitate a more inclusive and sustainable trajectory for livestock farming.

Another challenge is ensuring proper coordination and collaboration among different institutions involved in supervising and regulating livestock production. It is essential for there to be open communication and a clear distribution of responsibilities to ensure the effective implementation of established regulations and standards.

Market-based arrangements are dissected for their potential in economic incentivization and the promotion of sustainable practices through product differentiation and partnerships. The efficacy of such strategies is critically analyzed, with recommendations for bolstering their implementation highlighted as essential for progress.

Community arrangements are celebrated for catalyzing local involvement and decision-making, underpinning the promotion of sustainable practices. This research accentuates how such collaborative frameworks not only bridge livestock production with environmental conservation but also empower communities to act in their collective interest.

Within the scope of this study, the progress achieved through community agreements is attributed to the ejidal system's unique approach to territorial management and local decision-making in Mexico, which inherently supports the devolution of certain decision-making aspects.

The discourse culminates with an examination of polyarchic arrangements, advocating for a governance model that is inclusive of diverse stakeholder perspectives, thereby enhancing the formulation and implementation of sustainable strategies. Despite the advantages, the necessity to solidify these arrangements and empower local decision-making is underscored to ensure adaptability to specific community contexts.

The discussion does not shy away from the inherent limitations within collaborative governance, such as the complexities of establishing binding agreements and the risk of excluding vital stakeholders. An imperative component of this dialogue is the strategizing of financial mechanisms to sustain these governance spaces, recognizing that without fiscal support, the feasibility of executing sustainable initiatives is significantly compromised.

## 8 Conclusions and recommendations

This study contributes novel insights into the governance of sustainable livestock farming by critically examining a range of institutional arrangements in Jalisco, Chiapas, and Campeche. Our dual-method approach, integrating both qualitative and quantitative analyses, offers a nuanced perspective not commonly found in the existing body of literature, which typically focuses on singular governance models. This methodological innovation allows for direct correlation between governance structures and sustainable outcomes in livestock management. Nonetheless, the study is candid about its limitations, including the variability of stakeholder engagement and resource constraints, which could impact the application of these arrangements.

Future research is encouraged to conduct comparative analyses across different regions, which will deepen the understanding of how institutional arrangements adapt to various contexts. There's also a call

for investigations into stakeholder perceptions to unravel the intricacies of collaborative governance.

The actionable recommendations distilled from this study aim to propel sustainable livestock farming forward by:

- Enhancing local participation: encouraging the inclusion of local stakeholders in governance processes, potentially through advisory committees and capacity-building initiatives.
- Strengthening coordination: advocating for better cooperation among institutions overseeing livestock production to facilitate the enforcement of regulations and standards.
- Empowering communities: promoting community management practices that allow locals to make environmentally beneficial decisions, leveraging the success of intermunicipality models.
- Supporting collaborative governance: emphasizing the need for multi-stakeholder dialogue spaces and robust interinstitutional agreements for effective collaborative governance.
- Encouraging context-specific adaptation: recommending strategies be tailored to the distinct cultural, political, and socioeconomic contexts of each region for greater impact.

These recommendations are designed to address the identified challenges and capitalize on the opportunities to enhance the livestock sector's sustainability.

In summary, the research accentuates the value of collaborative governance in addressing sectoral challenges, highlighting the diversity of institutional arrangements that require context-sensitive strategies. The inclusive nature of collaborative governance, engaging a wide array of stakeholders, is essential for fostering trust, mutual learning, and commitment to sustainable policy implementation.

The study is pivotal in enhancing our comprehension of how institutional arrangements can drive sustainable livestock farming in Mexico, recognizing the complexities and the contingent nature of such arrangements.

By setting a clear direction for future research and offering a suite of evidence-based recommendations, the study seeks to influence policymakers and industry stakeholders to foster a livestock sector that is inclusive, sustainable, and responsive to the evolving environmental landscape.

## Author contributions

IA: Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing. CS: Funding acquisition, Project administration, Writing – review & editing. JB: Conceptualization, Investigation, Writing – review & editing. JJ-T: Conceptualization, Investigation, Writing – review & editing. EP-S: Conceptualization, Investigation, Writing – review & editing. AE: Conceptualization, Investigation, Methodology, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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