

Successful farmer-herder integration in African agropastoral systems: A systematic case study review



INITIATIVE ON
Fragility, Conflict,
and Migration

A working paper

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1. Context and justification

In the Sahel and West African regions, conflicts between farmers and herders are becoming increasingly recurrent, posing a challenge to peace, security and sustainable development (Moritz 2010; Adam et al. 2015; Adams et al. 2023; Tseer et al. 2024). They are often due to competition for access to and control of scarce natural resources, such as land and water, that are exacerbated by climate change, population growth and poorly executed agricultural practices (Atkilt 2013; Lenshie et al. 2022). In addition, these relationships are becoming strained due to the scarcity of arable land and water resources, the intensification of agriculture through the use of chemicals and the expansion of cropland at the expense of traditional transhumance routes (Djohy 2017; Turner and Schlecht 2019). Climatic factors, such as frequent droughts and climatic variations, have also contributed to the reduction of land available for agriculture and grazing and have facilitated the proliferation of pockets of rivalry between farmers and herders (Adams et al. 2023).

In addition to these factors, pastoralist communities are often isolated or even excluded from land use decision-making. Indeed, political decision-making based on ethnic, religious and identity ties has weakened peaceful coexistence (Kuusaana and Bukari 2015). Farmer-herder conflicts are getting increasing attention from academic research, but this typically focuses on elaborating the problems, particularly how, when and why conflicts emerge and the effects of those conflicts. There is much less research attention on the places and mechanisms by which farmers and herders successfully maintain peaceful and even mutually complementary relationships, even in the face of natural resource management (NRM) pressures. These complementary relationships have historical roots in the exchange of manure, crops and milk (Adimula and Idowu 2022; Gonin 2022).

Numerous cases of conflict between farmers and pastoralists have been documented in the literature. In Niger, the poor accommodation of livestock husbandry with crop agriculture and the convergence of subsistence practices have led to a number of conflicts, mainly due to increased competition for limited resources such as water and pasture, exacerbated by climatic variations and the expansion of crop land (Turner et al. 2011). In Cameroon, although ecological factors and poorly adapted land-use policies appear to be the main drivers of farmer-herder conflicts, the economic interests of colonial and post-colonial administrations have also played a significant role in the rise and persistence of these conflicts, particularly in northwest Cameroon (Mbih 2020). These cases illustrate the scale of the conflicts and the diversity of factors driving these tensions.

Development actors, policymakers and researchers have developed several approaches to contribute to effective coexistence between farmers and herders. One approach is crop-livestock integration, which requires cohabitation or collaboration between farming and pastoralist communities. This approach is defined as a combination of agricultural and pastoral activities in the same system or on the same 'terroir'. It is presented as a safe solution that significantly reduces conflicts and promotes social cohesion through coexistence between farmers and herders (De Haan et al. 2016). Apart from the implications of these approaches on social cohesion, other benefits include more efficient and sustainable use of natural resources through the establishment of a system of complementarity between crop and livestock production. These various elements provide sufficient evidence that the strengthening of social ties through appropriate mechanisms could therefore contribute to living together and peaceful cohesion between communities that are in search of the same resources (Knox and Jones Casey 2011). The implementation of these initiatives attests to the ability of local communities to get along, adapt and find lasting solutions to agropastoral conflicts.

Despite the different approaches developed to facilitate peaceful coexistence between farmers and herders, it is clear that the existing literature does not provide enough evidence on successful models of cohabitation or cooperation between them (Peter Yikwab and Tade 2022). To help drive the adoption and spread of these success models, it is important to understand the factors that contribute to their success. This systematic review article asks these research questions: What models of successful farmer-herder integration exist in the literature? What are the drivers of farmer-herder integration across models? What models of coexistence could be scaled up for the peaceful management of relations between farmers and herders over agropastoral resources? It addresses these research questions through analysis of scientific publications and grey literature to document the processes and institutional configurations that allow for economically productive and socially harmonious cooperation for the benefit of participatory natural resource management. Close analysis of the processes and institutional configurations that enable agropastoral integration and social cohesion between agricultural and pastoral communities will make an important contribution to identifying effective solutions and pathways that prevent and address farmer-herder conflicts. This will also enable a paradigm shift, with more attention being paid to what works, rather than what does not, or what causes problems.

1.1. Methodology

To conduct systematic reviews, several protocols and standards have been developed by scientists in recent years (Bayliss and Beyer 2015; Livoreil et al. 2017). The PRISMA model (Preferred Reporting Items for Systematic Reviews and Meta Analyses) is recognized as one of the most widely used models for systemic reviews. It provides a set of evidence-based practice tools designed to help authors systematically examine a large number of sources for literature reviews or meta analyses (Moher et al. 2015).

Although it is more widespread, PRISMA is subject to criticism that led to the design of the ROSES (RepOrting standards for Systematic Evidence Synthesis) standard (Haddaway et al. 2018). ROSES aims to improve and maintain high standards in the conduct of systematic reviews in order to improve the transparency and quality assurance of written systematic reviews. This new standard is suitable for studies that focus on environmental conservation and management. Three important elements characterize the ROSES standard: Firstly, the ROSES model ensures the description of the content needed for the examination and reduces overlaps. Secondly, it facilitates the rapid identification of key information related to the examination. Finally, it is characterized by its ability to maintain high standards in the conduct of systematic reviews. In view of these elements, the ROSES protocol was selected to carry out this systematic review. The methodological approach of this protocol includes several steps which are described below.

Search: This step gives an overview of the search strategy adopted, the search equation used for the different searches and the search engines used to find the documents to be used. This step also gives details of the languages considered for the search. The search strategy used is based on the Population, Intervention, Comparator, Outcome (PICO) model (Eriksen and Frandsen 2018). This model has made it possible to structure the research question and identify relevant keywords that can be used to find documents related to the research theme. Since the research topic does not include a comparison, the comparator has been excluded from the model. The model used is therefore the Population, Intervention, Outcome (PIO) model. The different keywords identified for each element of the model are presented in Table 1.

Table 1: PIO model and keywords

PIO model	Keywords
Population:	farmer, smallholder, herder, livestock, agriculturist, rural household, breeder
Intervention:	pastoralism, agriculture, agropastoralism, integrated agriculture, integrated farm, mixed farm
Outcome:	integration, collaboration, cooperation, partnership, coordination, synergy, participation, relationship

Based on the keywords identified with the PIO model, a search equation was constructed as follows:

("farmer" OR "smallholder" OR "herder" OR "livestock" OR "agriculturist" OR ("rural household") OR "breeder") AND ("agropastoralism" OR "integrated agriculture" OR "integrated farm" OR "mixed farm") AND ("integration" OR "collaboration" OR "cooperation" OR "partnership" OR "coordination" OR "synergy" OR "participation" OR "relationship")

The search for the different databases was done with the help of the Scopus and Web of Science databases. The choice of these two databases is justified by the fact that they cover a wide range of academic literature. In addition, they provide detailed information on topics related to natural resource and environmental management (Harzing et al. 2021) Existing literature in English and French has been duly considered. The search identified 824 documents: 272 documents were identified on Web of Science and 552 documents on Scopus.

Article screening and study inclusion criteria: At this stage of the protocol implementation, an initial phase consisted of eliminating duplicates identified among the 824 documents. In total, 158 duplicates were identified in the collection. Following this phase, a meticulous analysis of the titles and abstracts of the various articles led to the exclusion of 635 documents. At the end of this phase, 26 documents were retained then subjected to the inclusion and exclusion criteria presented below (Table 2). These criteria relate to the geographical area of the study, the relevance of the paper's objective and the nature of the study. These documents fully met the various inclusion and exclusion criteria listed.

Table 2: Inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Study area	African country	Another country
Period	2000-2024	Other year
Goal of paper	Present a clear, practical initiative that demonstrates a successful farmer-herder integration model.	Conflict relationship between farmer and herder
Study design	Case study	Another pilot study

Critical appraisal: The various documents identified were submitted to the PIO model. After this meticulous step, which led to the in-depth reading of each paper, 5 documents were selected for

their relevance and quality in relation to the model. At the same time, other studies were previously consulted and, although they were not part of the initial sample, they were added to the collection to enrich the analysis. This expanded collection was then re-subjected to the PIO criteria for in-depth narrative analysis. In the end, 11 documents were selected, representing 1.33% of the documents previously identified. The documents are presented in

Table 3.

Table 3: Case study documents selected

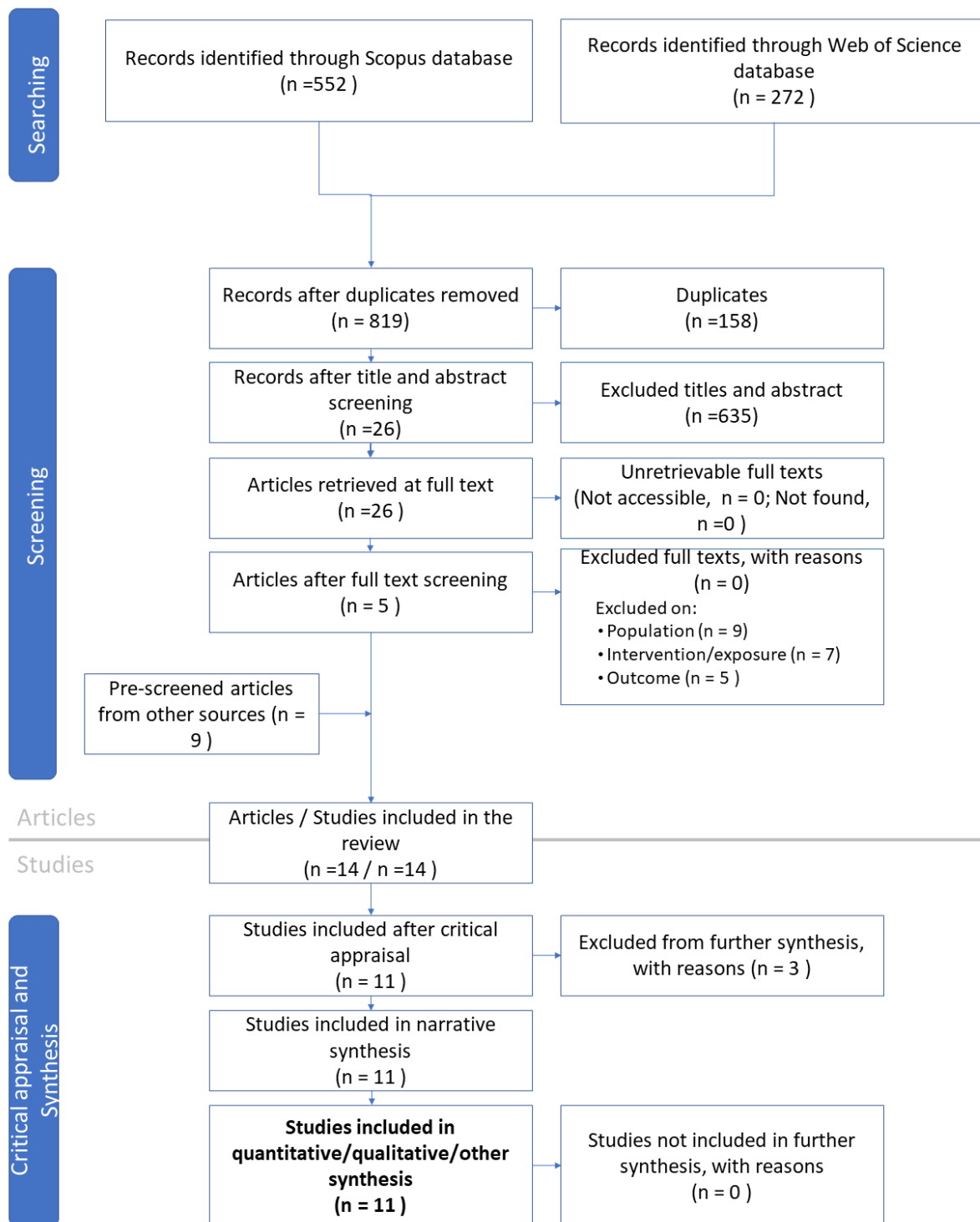
Authors	Year of publication	Title	Type of document	Source
Valkonen, Anni, Abdoulaye Kora, Moudachirou Soulé, Inoussa Guinin Asso and Bruno Oheix	2023	Modèle de gestion agropastorale Nexus « Gah Kêssê »	Working paper	German Society for International Cooperation (GIZ) GmbH
Setrana, Mary Boatemaa	2022	Promoting peace and managing farmer herder conflict: The role of civil society organizations in Agogo, Ghana	Journal article	African Studies Review
International Crisis Group	2021	Ending Nigeria's herder farmer crisis: The livestock reform plan	Working paper	Africa report no. 302
Bukari, Kaderi Noagah, Papa Sow, and Jürgen Scheffran	2018	Cooperation and co-existence between farmers and herders in the midst of violent farmer-herder conflicts in Ghana	Journal article	African Studies Review
Djohy Georges	2017	Pastoralism and socio technological transformations in northern Benin: Fulani innovations in pastoral migration, livelihood diversification and professional association	Book	Göttingen University Press
Eric Mutisya Kioko and Michael Bolliq	2015	Cross-cutting ties and coexistence: Inter-marriage, land rentals and changing land use patterns among Maasai and Kikuyu of Maiella and Enoosupukia, Lake Naivasha Basin, Kenya	Journal article	Rural Landscapes: Society, Environment, History
Bouaré Trianneau Kadidia Nianti	2013	Le riz et le bœuf, agropastoralisme et partage de l'espace dans le Delta intérieur du Niger (Mali)	Journal article	Les Cahiers d'Outre-Mer/ Revue de géographie de Bordeaux
Deneke, Tilaye Teklewold, Everisto Mapedza and Tilahun Amede	2011	Institutional implications of governance of local common pool resources on livestock water productivity in Ethiopia	Journal article	Experimental agriculture

Gebremedhin, Berhanu, John Pender and Girmay Tesfay	2004	Collective action for grazing land management in crop-livestock mixed systems in the highlands of northern Ethiopia	Journal article	Agricultural Systems
Banzhaf, Matthias, Boureima Drabo and Hermann Grell	2002	Conflict to consensus: Replacing rivalry with effective resource management in Burkina Faso	Working Paper	Securing the Commons N°3
Diallo, Youssouf	2001	Conflict, cooperation and integration: A West African example (Côte d'Ivoire)	Working Paper	Max Planck Institute for Social Anthropology

Data extraction: In the data extraction process, the aim was to systematically gather qualitative information relevant to answering the research question on the institutional processes and mechanisms of cooperation between farmers and herders. This involved breaking down the question into specific, observable elements that could be identified in the documents and literature. Thus, clear criteria were established to guide the extraction. These criteria relate to the description of the case studies and the identification of factors favouring co-existence between farmers and herders. We also sought information on institutional processes, such as decision-making procedures, governance structures and conflict resolution mechanisms, as well as policy frameworks influencing interactions between farmers and herders. In terms of configurations, we identified patterns of collaboration, such as shared resource management agreements or formal and informal arrangements between these groups. For cooperation mechanisms, we targeted concrete practices such as land-sharing agreements, rotational grazing schedules and water-sharing systems. Finally, we extracted data on sustainability and success factors, analysing the social, economic and environmental factors that make these mechanisms sustainable. This methodological process has enabled us to build a rich database, facilitating narrative analysis and the identification of recurring themes, case studies and success factors.

Data synthesis and presentation: The data were analysed qualitatively to identify themes and trends in the mechanisms of cooperation, collaboration or coexistence between farmers and herders. Graphs and descriptive statistics were then generated to visually illustrate the results and facilitate interpretation. The model is summarized in Figure 1.

Figure 1: ROSES model (by the authors).



1.2. Limitations of the study

Some limitations were identified in the methodology adopted for this study. These can be summed up in three main points:

1. While the systematic review method adopted is considered one of the most rigorous, it is limited by the limited number of documents available on the subject. Indeed, the limited

availability of literature on the subject limited access to comprehensive empirical data that would facilitate a strict application of the study design.

2. The inclusion and exclusion criteria may also have limited the diversity of the studies analysed with regard to case studies from different regions with different socio-economic backgrounds.
3. Finally, although the participatory approach and collaborative governance models are widely promoted in development interventions, their actual implementation and long-term impacts remain under-represented in the existing literature.

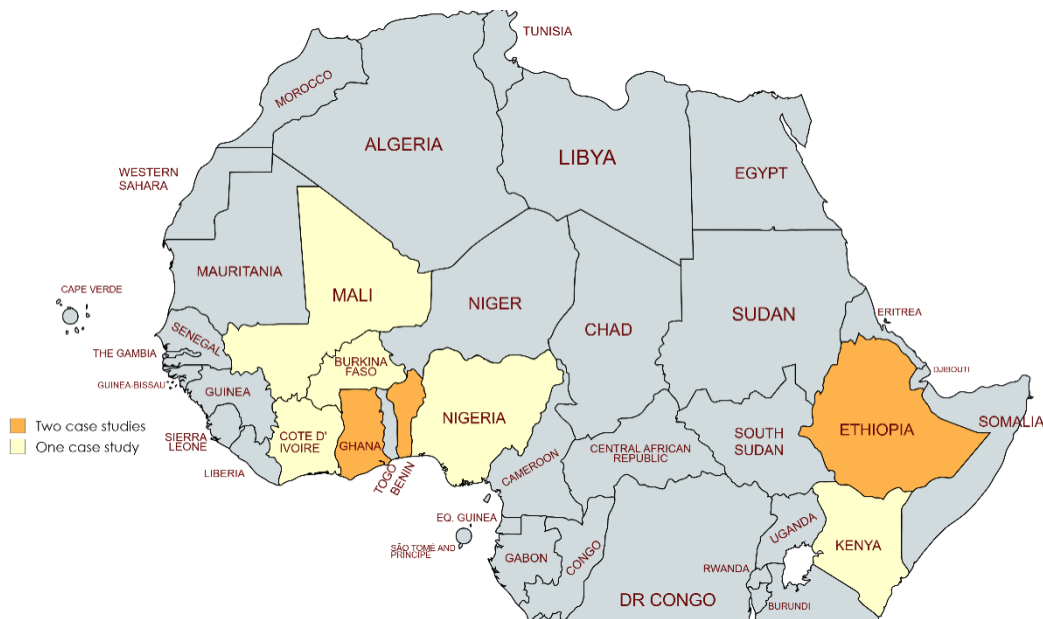
The selected case studies offer important perspectives but do not comprehensively cover the diversity of local practices and contexts across the African continent. However, these limitations in no way compromise the quality of this literature review and the methodological rigour adopted in its writing.

2. Results

2.1. Geographical distribution of the case studies

The case studies selected for the analysis of cooperative or collaborative relationships between farmers and herders are spread across eight countries in East and West Africa. For the East African region, three case studies were identified in two countries: Ethiopia and Kenya. Eight case studies were selected in six West African countries: Benin, Burkina Faso, Ghana, Mali, Nigeria and Côte d'Ivoire. The importance of livestock and farming systems in these two regions justifies the coverage of these areas by the case studies. According to statistics from the Food and Agriculture Organization of the United Nations (FAO 2019), more than 50% of Africa's livestock are in East Africa. Ethiopia has the largest number of cattle in Africa (Management Entity 2021). In West Africa, agropastoral activities employ a large part of the working population.

Figure 2: Map of distribution of case studies (by the authors).



2.2. Types of documents in the collection

Three categories of documents are retained in the collection: A book (01), working papers (04) and scientific articles (06). Books are poorly represented, which can be explained by their less frequent use in literature reviews on specific topics or recent case studies. Working papers, on the other hand, are widely used. They allow researchers to quickly share their findings and receive feedback, which is particularly useful for emerging topics or rapidly evolving fields such as our study, which focuses on the institutional processes of agropastoral cooperation. Scientific articles dominate the selection, reflecting the importance and relevance of scientific publications in current research. These peer-reviewed articles ensure a high level of scientific rigour and credibility. They also provide empirical data and recent analyses that are essential for examining contemporary issues such as farmer-herder collaboration.

The distribution of the types of publications therefore shows a predominance of journal articles, followed by working papers and books. This distribution reflects the diversity of sources used to obtain a thorough and up-to-date understanding of the mechanisms of collaboration between farmers and herders. Journal articles provide rigorous and validated analyses. Working papers offer innovative and recent perspectives while books provide a broader theoretical and contextual framework. This combination of sources ensures complete and balanced coverage of the subject under study.

2.2.1. Case studies on models of cooperation between farmers and herders

The integration of agricultural and pastoral activities presents both challenges and opportunities in African countries. This section explores successful models of cooperation between farmers and herders in different regions of the continent. Each case study illustrates how communities manage the complex interactions between agriculture and livestock through the implementation of innovative approaches that facilitate coexistence. The literature has identified 11 cases that are presented in this section. Each of the case studies presented has a specificity in the approach it adopts. They are presented in order, from the most recent case study to the oldest.

2.2.2. Nexus 'Gah Késsé' agropastoral management model

The Nexus 'Gah Késsé' agropastoral management model was developed in Benin as part of the Global Project for the Promotion of a Responsible Land Policy (PROPLP) with the objective of improving the livelihoods of agropastoral communities (Valkonen et al. 2023). It was designed by the German Agency for International Cooperation (GIZ) and local partners and implemented in Tchatchou District of Tchaourou Commune. The 20,000 hectare implementation area is spread over 16 villages with an estimated human population of 5,300 and a cattle herd of 11,500 head.

The model was implemented for 10 months between 2022 and 2023 and developed three essential phases that have interconnected stages. The first stage is the preparation phase, which has made it possible to raise awareness and mobilize communities around the objectives and benefits that could be provided by the success of this model. During this phase, a participatory diagnosis was made through field surveys and focus groups to identify the needs and expectations of each stakeholder. The final stage of the preparation phase was dedicated to the planning and design of a detailed action plan that defines the roles and responsibilities of each stakeholder in the model based on the data collected.

The second phase is the implementation of the model, including the development of management zones and the creation of concentric geographical zones for agriculture and livestock. These different stages have made it possible to access water and fodder for the communities, especially for livestock. Infrastructure has been built, including hydraulic structures, shelters for cattle herds and fodder storage facilities. At the technical level, capacity building and training have been provided to farmers and herders on modern agropastoral techniques and the sustainable management of natural resources. The training provided to farmers and herders has also taken into account the development of new income generating activities such as market gardening and milk marketing.

The third phase consists of the analysis and documentation of the project's impacts on the beneficiaries represented by the local community, ecosystem services, lessons learned and difficulties encountered in order to prepare extension plans.

Several stakeholders have been involved in the implementation of this model, including the local communities represented by farmers' and herders' associations. Institutional and decentralized actors such as the High Commission for the Sedentarization of Herders (HCSE), Ministry of

Agriculture, Livestock and Fisheries (MAEP), Association for the Development of Borgou Municipalities (ADECOP) and Tchaourou Municipality have provided technical and political support in the implementation of the model. Service providers have contributed to the development and construction of infrastructure in the area and an agropastoral association of farmers and herders has been set up to coordinate and manage activities over the long term. Technical and financial partners have supported the implementation of the model. Researchers have also been involved in studies to evaluate the benefits of this model and its long-term effects.

This model shows a synergy of actions between different actors and between agriculture and livestock systems. Its implementation contributes to improving income, access to services (water and fodder) and strengthening social cohesion at the agropastoral community level. By establishing clear governance structures, roles and responsibilities, local institutions facilitate cooperation and conflict resolution. Participatory diagnosis and the involvement of local communities ensure that the needs and expectations of all stakeholders are taken into account, thereby increasing buy-in and commitment to long-term cooperation.

The relationship between strengthening local institutions and investing in technical elements is interdependent. Strong local institutions provide the framework for the successful implementation of technical investments, such as water and fodder infrastructure, and capacity building initiatives. These technical elements, in turn, improve the productivity and sustainability of local agropastoral systems, further motivating stakeholders to actively cooperate.

2.2.3. Farmer and Fulani pastoralist coexisting in Agogo: The role of civil society organizations

Sestrana's (2022) study examined the role of civil society organizations (CSOs) in promoting peaceful coexistence between farmers and herders in the traditional Agogo region of Ghana. This community has often been the scene of conflict between local farmers and Fulani herders, mainly due to competition for access to water and land. Land agreements between the two parties have often been violated, leading to conflicts over access to vital resources and claims to land ownership. In the face of these recurring tensions, several civil society organizations have played a crucial role in managing interactions between the two groups and reducing conflict.

The Agogo Youth Association (AYA) has played a particularly important role in protecting and supporting indigenous farmers. This association has been instrumental in helping farmers reclaim their land and assert their land rights. By focusing on defending the interests of local farmers, AYA has helped to reduce tensions by providing a voice and organizational support to the farming community. Through its efforts, farmers have been able to better organize their demands and respond to the challenges presented by competition from Fulani cattle herders for access to resources.

On the other hand, the Suudu Baaba Association of Fulani in Ghana (SBAFG) has helped to give the often marginalized herders a voice. It has defended their rights and facilitated communication with other groups. This organization has helped to present the interests of Fulani herders to local and national authorities. It has played a key role in their better integration into society and the recognition of their rights. By giving voice to the concerns of the herdsman, SBAFG has helped to improve mutual understanding between the actors in the community.

The Agogo Community Association (ACA) has also played a central role in managing interactions within the community. This organization has facilitated exchanges between different community groups and worked to promote inclusive and sustainable solutions for all residents. By promoting social cohesion, the ACA has helped to create a more harmonious environment where cooperation and dialogue have replaced confrontation and open conflict.

In addition, the diaspora-based Agogo Worldwide Association (AWA) has provided valuable logistical and financial support to the local community. By mobilizing resources through fundraising and providing logistical support, AWA has helped to strengthen local efforts in conflict resolution and community development. This organization has acted as a bridge between the diaspora and the local community, enabling local initiatives to be strengthened by international support.

Finally, the Better Agenda for Fulbe in Ghana (BAFG) has focused on conflict prevention by raising awareness of land rights and best practices among Fulani herders and their families. By educating herders about land agreements and promoting a better understanding of local rules, this organization has helped to reduce misunderstandings and violations of land agreements. Through its preventive role, BAFG has played a key role in improving relations between pastoralists and other community members, thus contributing to peaceful coexistence.

Overall, these civil society organizations have played a fundamental role in promoting peaceful coexistence between farmers and herders in the Agogo region. Their collective action has reduced tensions, strengthened communication and supported community development, ensuring more balanced conflict and resource management in the region.

2.2.4. Agropastoral policy as a management model in Nigeria

For several decades, Nigeria has been facing a persistent crisis between farmers and herders, primarily in the northern and central regions of the country (International Crisis Group 2021). These conflicts, exacerbated by climate change, environmental degradation, rapid population growth and insurgencies such as Boko Haram, have driven herders, mainly Fulani pastoralists, to migrate south in search of pastures and water, thus coming into conflict with local farmers over land and water resources. The resulting clashes have resulted in thousands of deaths, significant disruption to rural economies and a threat to national stability.

In response to this crisis, the Nigerian government launched the National Livestock Transformation Plan (NLTP) in 2019. This plan is based on a cooperation mechanism that integrates several key elements to transform livestock practices and encourage peaceful coexistence between farmers and herders. One of the key strategies is to establish livestock ranches and grazing reserves, to promote sedentary livestock practices and reduce competition for land and water resources.

Adamawa is one of the pilot states for the implementation of the NLTP. This state was selected due to its strategic location and the numerous challenges related to conflicts between farmers and herders. The plan's implementation activities in this state include several important initiatives: In order to coordinate local efforts, Adamawa has established livestock transformation offices. These offices serve as the central hub for managing and supervising activities related to the plan, in collaboration with local authorities and communities. The state government has funded awareness campaigns on local radio and television. Meetings have been held with herders, farmers, civil society organizations, traditional leaders and community leaders to explain the details of the plan and its potential benefits. The state has designated several grazing reserves as sites for ranch projects under the plan, including the Gongoshi, Guyaku, Nassarao Jada, Dauchi and Saurata reserves. The sites were selected based on their potential to provide adequate pastureland and to minimize land use conflicts. Additionally, Adamawa has sought to establish partnerships with private investors to reinforce the infrastructure required for the plan's implementation. These partnerships are crucial for the development of ranches and livestock product processing facilities.

This case study shows that the development of strong local institutional relationships is essential to fostering complementarity between farmers and herders and creating incentives for peaceful coexistence. The establishment of livestock processing offices in Adamawa, which act as management centres for activities related to the NLTP, highlights the importance of localized

coordination. By involving key stakeholders—such as local authorities, civil society organizations, traditional leaders and community members—the plan ensures that all parties are informed and invested in the success of the initiatives. This inclusive approach not only facilitates cooperation but also builds trust and commitment among the communities involved.

The relationship between strengthening local institutions and investing in technical elements is mutually reinforcing. Strong local institutions, such as livestock processing offices, are essential to managing and overseeing technical investments such as the creation of ranches and grazing reserves. These technical developments, including partnerships with private investors to improve infrastructure, are necessary for the practical implementation of the NLTP. Investment in institutional structures and technical elements will help to ensure the sustainability of livestock transformation and reduce conflicts over resources.

2.2.5. Farmer-herder cooperation and coexistence in Ghana based on social, cultural and historical links

The case study presented by Bukari et al. (2018) illustrates a model of cooperation based on socio-cultural and historical relationships. The relationship between farmers and Fulani herders in Ghana is characterized by a complex interplay of violent conflict and peaceful cooperation. This contrast is particularly evident in the areas of Kovereso, in Asante Akim North District of southern Ghana, and Zantile, in Gushiegu District of northern Ghana. In Kovereso, relations between farmers and herders are characterized by cordial interactions and well-established conflict resolution mechanisms, despite a relatively recent coexistence. In Zantile, a peaceful coexistence and deep social and religious ties have existed for over 20 years, fostering structured and enduring cooperation.

Relations between farmers and Fulani herders in Kovereso are marked by notable cordiality, with no violent conflicts or recorded deaths. Herders and farmers share resources, including land and water. Fulani herders purchase goods such as sugar, bread and other foodstuffs from the farmers in exchange for milk. In cases of crop destruction by livestock, compensation is negotiated and paid to the farmers, often with the assistance of the local unit committee, which facilitates the negotiation. Fulani herders actively participate in community projects, such as well digging, and contribute financially to these initiatives. Social interactions are also frequent and positive, with exchanges of meals and gifts, and joint participation in social events such as weddings and funerals, thereby strengthening community bonds.

Fulani herders and Dagomba farmers in Zantile have coexisted peacefully for over 20 years, thanks to effective communication and clear community rules. Land is provided to the Fulani herders for settlement, livestock rearing and cultivation. During the dry season, water is shared between farmers and herders. Conflicts are resolved locally by traditional chiefs, who play a key role in mediating disputes and determining compensation payments, often without police intervention. Social and religious relations are also strong, with both groups praying together in mosques and jointly celebrating religious festivals. The Fulani participate in local social ceremonies, exchanging gifts, and provision of material assistance to farmers, reinforcing social solidarity through regular visits and financial contributions to social events.

The two areas under consideration, Kovereso and Zantile, demonstrate both points of convergence and divergence in terms of collaboration between farmers and Fulani herders. These areas demonstrate how disparate communities can coexist peacefully despite their distinct social, cultural and historical contexts.

With regard to convergence, both communities maintain amicable and respectful relations between farmers and herders. Effective communication is a crucial factor in both areas. Formal and

informal channels facilitate the prompt resolution of misunderstandings and the prevention of conflicts. Respectful and friendly relations, fostered by effective communication, are the basis for convergence between farmers and herders. This communication facilitates the prevention and rapid resolution of conflicts through formal and informal channels. Formal channels include traditional chiefs, community committees and local authorities. These bodies play a key role in mediating conflicts, particularly in the case of crop destruction by herds, by facilitating compensation payments and regulating interactions. Informal channels take the form of everyday interactions such as the exchange of goods and greetings, friendship and social solidarity. These interactions prevent tensions from escalating and strengthen ties between the two communities. For example, in some areas, farmers and herders continue to engage in economic and cultural exchanges, such as exchanging milk and food, which help to build mutual trust and stabilize their relations despite disputes. Another common characteristic is resource sharing, with land and water shared between farmers and herders, allowing for optimal use of the available resources. Both communities demonstrate a high level of social interaction and solidarity, with regular exchanges of visits, gifts and material assistance. This fosters an atmosphere of conviviality and mutual respect.

However, despite these similarities, there are notable differences between the two areas. In Kowereso, relations are relatively recent and have evolved towards peaceful coexistence through regular interactions and local mediation. In Zantile, relations are long standing, with peaceful coexistence well established for over 20 years, supported by clear community rules and strong religious ties.

The approach to conflict resolution differs between the two regions. In Kowereso, the local unit committee plays a significant role, while in Zantile, traditional chiefs are the primary mediators, with minimal police involvement. Regarding resource sharing, in Kowereso, agreements are often informal, with regular exchanges of goods and services between herders and farmers in their communities. In Zantile, land and water are shared in a more structured manner, with official agreements for the settlement of Fulani herders and well-established practices for accessing water during the dry season.

Finally, social interactions in Kowereso are centered on exchanges of gifts, shared meals and joint participation in social events. In Zantile, social interactions are further strengthened by common religious ties, with joint participation in prayers, religious festivals and social ceremonies.

In conclusion, while both areas share common characteristics of cooperation and peaceful coexistence, they differ in their history of relations, conflict resolution, resource sharing structures and social interactions. These differences reflect the unique cultural, historical and social contexts of each community, illustrating how different dynamics can influence relations between farmers and herders in varied environments.

This mechanism for managing farmer-herder relations relies on the involvement of local institutions, such as committees and traditional leaders, to prevent and quickly resolve conflicts. Informal channels of communication, such as daily interaction and participation in social events, strengthen trust and community ties. Finally, clear rules for sharing resources such as land and water ensure peaceful and sustainable coexistence and reduce tensions over access to resources.

2.2.6. Farmer-herder coexistence driven by pastoralist professional association in Benin

In his book, 'Pastoralism and socio-technological transformations in northern Benin', Djohy (2017) provides a comprehensive account of conflict resolution between farmers and herders by the National Association of Professional Ruminant Herders' Organizations in Benin (ANOPER). The study focuses on northern Benin, a region where Fulani pastoralists and Bariba farmers coexist.

ANOPER has implemented a structured and hierarchical mechanism to facilitate the amicable resolution of disputes. This mechanism begins at the local level with the Groups for the Promotion of Ruminant Breeding (GPER) and extends to the national level with ANOPER, which serves as the Supreme Court for these conflicts. In the event that peaceful resolution attempts fail at the lower levels, the conflict is escalated to the Departmental Union of Professional Ruminant Herder Organizations (UDOPER) at the provincial level, and subsequently to ANOPER at the national level.

The actors involved in this mechanism include several organizations. At the national level, ANOPER is responsible for addressing the most serious cases. Its role is to ensure effective and impartial mediation, as well as to coordinate conflict management activities across the country. At the provincial level, UDOPER serves as an appellate court. If a conflict cannot be resolved at the local level, it is escalated to UDOPER, which reviews the cases and makes decisions to resolve disputes. This provides a second chance for amicable resolution before the conflict reaches the national level. GPER, at the village level, is the first point of contact for resolving conflicts between farmers and herders. They facilitate discussions and local mediations to address disputes as they arise. Their role is pivotal in preventing conflicts from escalating. ANOPER also employs a lawyer to advocate for the rights of herders. In the event of serious cases involving injuries or loss of life, the lawyer takes legal action, reinforcing the organization's credibility and impartiality. Finally, local Fulani leaders play a crucial role in local mediation, facilitating communication and understanding between conflicting parties. They use their influence and authority to defuse tensions and promote peaceful resolutions.

The ANOPER mechanism prioritizes amicable mediation, with strong involvement of local Fulani leaders. A well-defined hierarchical structure allows conflicts to be managed in an ascending manner, ensuring that each level has the opportunity to resolve the dispute before it is escalated. In the event of a serious conflict, legal intervention is sought. Furthermore, the use of communication technologies, such as mobile phones, and vehicles funded by international donations enables rapid intervention at conflict sites, ensuring that situations can be addressed promptly and effectively.

The success factors of this mechanism include the impartiality and legitimacy of ANOPER's decisions, reinforced by the presence of a lawyer, which enhances the organization's credibility. Social networks and community solidarity also play a crucial role in conflict resolution, facilitating mediation and dialogue. The financial and logistical support of international donors allows for effective and rapid conflict management, ensuring that the necessary resources are available for timely intervention. Finally, ANOPER's participatory approach, which actively involves herders in decision-making and conflict resolution processes, contributes to the promotion of peaceful coexistence between farmers and herders and the strengthening of the resilience of pastoral communities in the face of contemporary challenges.

The conflict resolution mechanism set up by ANOPER is based on structured mediation at several levels. It starts at the local level with the GPER, escalates to the departmental level with the UDOPER and ends, if necessary, at the national level with ANOPER. By involving local Fulani leaders and using modern means of communication to intervene quickly, this hierarchical system promotes the amicable resolution of disputes. The legitimacy and effectiveness of this process is enhanced by the addition of a lawyer to defend the rights of the herders.

2.2.7. Peaceful coexistence: Transforming conflict into cooperation between the Kikuyu and Maasai in Kenya's Lake Naivasha Basin

Kioko and Bollig (2015) examine the peaceful coexistence between agricultural and pastoral communities, specifically the Kikuyu and the Maasai, in the Lake Naivasha Basin region of Kenya. The study area is located between Nakuru and Narok counties and is a geographical extension of the Mau Escarpment. This region is approximately 2,400 metres above sea level and receives

significantly more rainfall than the adjacent lowlands. The soils are highly fertile, allowing for up to three harvests per year.

In the colonial era, the Nakuru side of the study area was occupied by white-owned commercial farms, while the Narok side was part of the Southern Maasai Reserve. Today, the Nakuru side consists of Maiella Sublocation and the Narok side of Enoosupukia Location. The latter is particularly known for its history of ethnic violence in Kenya's Rift Valley. Tensions often arose from differing land use priorities, with the Kikuyu moving to traditionally Maasai lands for agricultural purposes. These migrations and the acquisition of land by the Kikuyu often led to violence, including organized attacks by the Maasai against Kikuyu farmers in 1993, resulting in the death of more than 20 farmers and the forced expulsion of thousands of Kikuyu. Despite this tumultuous past, intercommunity relations between the Maasai and the Kikuyu are now surprisingly peaceful. Cooperative use of natural resources has become the norm rather than the exception.

This transition has been facilitated by several key factors. Inter-ethnic marriages between the Maasai and Kikuyu reflect the historical relationship between these two communities. They have helped to forge cross-cutting social links. These marriages have helped to deconstruct group identity formations and have contributed to the peaceful management of conflicts. The Maasai began renting land to Kikuyu farmers, thus transforming the land into a shared rather than contested resource. This process enabled the Kikuyu to cultivate land while maintaining Maasai property rights. Frequent interactions and negotiations between Maasai landowners and Kikuyu tenants have strengthened trust and social relations. Peace forums and local peace committees have played a significant role in conflict resolution and the promotion of peaceful coexistence. Kikuyu women married to Maasai men have introduced agricultural techniques and commercial activities that have helped stabilize Maasai households. This includes the adoption of food crops and improved agricultural practices, which has reduced the dependence on cattle sales for purchasing food.

The mechanism for managing the peaceful coexistence between the Maasai and the Kikuyu is based on the roles and responsibilities of various actors. Local peace committees, comprising local chiefs, elders and community leaders, play a pivotal role in mediating conflicts and fostering intercommunity dialogue. Women, particularly those married across communities, act as cultural bridges, facilitating mutual understanding and respect for each group's customs and traditions. The Maasai landowners, by renting land to Kikuyu farmers, have created an economic interdependence that fosters cooperation and stability. The sustainability factors of this peaceful coexistence include mutual recognition of the economic benefits derived from cooperation, the establishment of permanent dialogue structures such as peace committees, and the encouragement of mixed marriages that strengthen social and economic ties between communities. The ability to resolve conflicts non-violently, supported by community development initiatives and the engagement of local actors in collaborative agricultural and commercial practices, also contributes to the sustainability of this peaceful coexistence.

The peaceful coexistence of these communities has led to significant economic and social benefits for both. The exchange of economic and material resources has led to an increase in interdependence and contributed to regional stability. Mixed marriages have also enhanced social and economic networks, thereby facilitating non-violent conflict management.

This case study highlights the pivotal role played by growing relations and conflicting loyalties, stemming from mixed marriages and land rentals, in transforming conflictual relationships into peaceful coexistence. These mechanisms have enabled the Maasai and the Kikuyu to transcend ethnic divisions and build a more cohesive and cooperative society.

2.2.8. The case of rice farmers and cattle herders in the Inner Niger Delta in Mali

Agriculture and livestock farming have coexisted in the Inner Niger Delta in Mali for centuries. This case study, published by Bouaré Trianneau in 2013, presents the example of rice farmers and cattle herders, who share this territory, working together to manage space and natural resources. In this region, soil fertility and water availability due to seasonal flooding allow for the coexistence of rice cultivation and cattle farming.

Historically, land was distributed according to customary rules based on principles of gerontocracy, seniority, first settlement and the hierarchy of gender relations. However, the recent decades have brought about significant changes in these dynamics due to climatic and economic upheavals. The introduction of Small Village Irrigated Perimeters (PPIV) has resulted in a reduction of grazing areas, with certain zones being reserved exclusively for rice cultivation. This has compelled herders to modify their practices, notably by relocating to pastures situated at greater distances from rice growing areas.

Several factors have contributed to the relative success of land management between rice farmers and herders in this region. Among these factors, four deserve particular attention:

Adaptation of agricultural and pastoral practices: Local actors have developed flexible and adaptive practices, such as manure contracts, where rice farmers provide housing and food to herders in exchange for cattle manure, which enriches the soil for rice cultivation.

Legal framework and land tenure security: The implementation of the Land and Property Code in 2000, followed by the Pastoral Charter in 2001, provided a legal framework aimed at securing the land rights of various stakeholders. These laws recognize customary rights and promote collective and local land management.

Community participation and transfer of competences: Legislative reforms have encouraged the transfer of competences to local authorities and the empowerment of local populations in resource management. This has allowed for more equitable and sustainable land management, taking into account the needs of all users.

Innovation and diversification: Communities have also innovated by diversifying their activities and adopting new agricultural and pastoral techniques, enabling them to maximize the use of limited resources while reducing conflicts.

The management of territories between rice farmers and herders in the Inner Niger Delta in Mali relies on a combination of adapted traditional practices, a strengthened legal framework, community participation and ongoing innovations. These elements have maintained a fragile but essential balance for the coexistence of the two production systems.

2.2.9. Collaborative governance enhances livestock water productivity in Ethiopia: A study of indigenous and external structures

The study conducted by Deneke et al. (2011) in the Amhara region of Ethiopia demonstrates how collaboration between farmers and herders has enhanced access to water and improved livestock water productivity (LWP). The term 'livestock water productivity' is defined as the ratio of beneficial livestock-related products and services (such as meat, milk, traction, hides and manure) to the water used to produce them. To improve LWP, it is essential to effectively manage water and grazing resources, and this relies heavily on local governance structures.

The two kebeles studied, Kuhar Michael and Lenche Dima, exemplify the challenges and successes of this collaboration. Kuhar Michael, with an area of 2,755 hectares and a population of 6,661, is situated in an area with a relatively high water abundance. The area is equipped with a modern

irrigation system for rice production, the Guanta Lomidur, covering 102 hectares, as well as a small traditional irrigation system covering approximately 40 hectares. Lenche Dima, on the other hand, spans 1,546 hectares, with a population density of 218 people per km², and is situated in a more arid zone. The area is irrigated using traditional methods on approximately 80 hectares, with a further 360 hectares being irrigated using a modern system that draws water from River Alewuha.

The disparity in water availability between these two kebeles has a profound impact on resource governance and management. In these communities, traditional governance structures, such as the 'kire', have played a crucial role. The kire is an indigenous participatory organization, primarily created for mutual aid in the event of death, but also used for the management of water harvesting ponds and other common resources. In the villages of Lenche Dima, each kire is responsible for mobilizing local labour for the maintenance and protection of water harvesting ponds, which are essential for providing drinking water to livestock during the dry season. All farmers in the region are members of the kire, which also oversees the protection and maintenance of the ponds. Noncompliance with the kire's established rules is subject to fines and may result in social isolation, and this ensures a high level of compliance and community cooperation. Furthermore, elected groups such as the 'yebere-sar-tebaki' ('guardians of grass for oxen' in Amharic) have been established in Lenche Dima to manage communal grazing lands and allow access for oxen used for plowing at specific times of the year. These groups are responsible for the closure, protection and management of communal grazing plots, as well as the organization of grazing periods to prevent overuse and ensure equitable resource distribution. The collective management approach has led to increased vegetative cover and pasture productivity, which has in turn contributed to enhanced livestock water productivity.

Furthermore, interactions between different actors, notably farmers, herders and local authorities, have also played a crucial role. For instance, in Kuhar Michael, farmers who use motorized pumps to irrigate their fields have sometimes benefited from preferential water rights, which has created tensions with users of traditional systems. However, indigenous governance structures have often succeeded in overcoming these challenges by mobilizing communities for collective and equitable management. In contrast, external governance structures, such as government-imposed water committees, have often been unsuccessful due to their lack of local ownership and community support. These committees, while well intentioned, have not achieved the same level of acceptance and effectiveness as indigenous structures like the kire and the yebere sar tebaki.

2.2.10. Collective management of grazing lands in Tigray, Ethiopia

In the Tigrayan highlands, farmers and herders are facing serious degradation of their communal grazing land (Gebremedhin et al. 2004). Like many others in the arid and semi-arid regions of northern Ethiopia, the village of Enda Mariam depends on subsistence agriculture, combining crop farming and livestock rearing to survive. The irregular and concentrated rainfall, primarily between June and August, adds further pressure on the already limited resources.

For decades, the communal grazing lands of Enda Mariam were used in an uncontrolled manner, leading to severe soil degradation. Farmers needed their oxen for plowing and transportation, while herders relied on crop residues as a source of fodder for their livestock. This interdependence created an urgent need to find a sustainable solution so the community decided to come together and discuss ways to collectively manage their grazing lands to prevent further degradation. With the help of a few respected elders, the village administration organized regular meetings where all community members could voice their concerns and propose solutions. Together, they established rules for land use, such as specific grazing periods for different types of animals and prohibitions on cutting trees and shrubs without permission.

To protect these lands and enforce the rules, the villagers agreed to each contribute towards the hiring of a guard. This guard, a trusted member of the community, was compensated in cash and sometimes in kind, such as with grains or milk, to ensure the grazing lands were well monitored and protected against unauthorized intrusions. The guard often had to mediate conflicts between farmers and herders, especially during times of food scarcity. For example, during an unusually dry month, some herders attempted to graze their animals outside the permitted periods, leading to disputes with farmers who feared for the health of their crops. To resolve these conflicts, the community established a system of penalties. Any violation of the land use rules resulted in a fine. These penalties were enforced strictly, quickly deterring non-cooperative behaviours. The revenue generated from these fines was reinvested in community projects, such as improving soil and water conservation infrastructure.

The initiative in Enda Mariam caught the attention of the Regional Bureau of Agriculture, which provided technical and material assistance to support the community's efforts. With this support, the villagers gained access to training on soil conservation techniques and improved seeds for forage crops. Over time, the results were impressive. The grazing lands began to regenerate, providing more abundant and nutritious fodder for livestock. Farmers noticed an improvement in crop productivity due to the use of animal manure. The cooperation between farmers and herders strengthened, and conflicts diminished. This successful experience demonstrated that effective collective management of natural resources is possible through strong community collaboration. The relationships between farmers and herders, supported by robust organizational structures and appropriate external assistance, were essential in creating a sustainable and beneficial system for all community members.

2.2.11. Co-management of natural resources in Kishi Beiga, Burkina Faso

Located in the Oudalan Province in northern Burkina Faso, Kishi Beiga was a pastoral zone beset by numerous problems (Banzhaf et al. 2002). The historical conflicts inherited from the colonial and revolutionary periods had left deep scars. The management of natural resources was disorganized and lacking clear rules, leading to violent conflicts among the various local communities. The droughts of the 1970s and 1980s had exacerbated the situation, causing the degradation of natural resources and increasing rivalries between farmers and herders over access to these resources. Leadership was also a major problem, with conflicts between the different communities, notably the Touareg, Bellah and Mallébé, each claiming rights and power over the others.

To address these challenges, a new resource management mechanism was implemented. A participatory approach was adopted, focusing more on social entities rather than fixed territorial units. This led to the creation of a consultation framework that brought together all social groups in the area, including herders, agropastoralists, women and youth. This consultation framework served as a platform for discussing and resolving conflicts and for developing local rules for the use of natural resources. These rules aimed to prevent conflicts and ensure the sustainable and equitable management of resources. The initiative was supported by the Programme Sahel Burkinabé (PSB), funded by Germany through the GTZ (now GIZ). The project primarily aimed to combat desertification and promote rural development through the application of the terroir management approach. This approach involved participatory and bottom-up planning, giving villagers decision-making power on the use and management of their lands. The project also emphasized learning and adapting its methodologies to better meet local realities and the specificities of the agropastoral region.

The project was launched in 1991 in Kishi Beiga. Initially focused on the single village of Beiga, the intervention now encompasses an area of 19 hamlets grouped into three administrative units (villages), with an estimated area of 400 km² in 1998. The initial measures taken by the project in the Kishi Beiga area included the establishment of a Village Terroir Management Organization (CVGT).

This organization aimed to facilitate the management of natural resources by local communities. Initial actions included the construction of various infrastructures, the beginning of a participatory diagnosis, and some anti-desertification measures such as the construction of stone bunds, reforestation and the protection of certain areas. However, several shortcomings were quickly identified.

The CVGT was not representative of all groups present, notably transhumant herders, which created an imbalance and tensions within the community. Additionally, dysfunctions emerged in the management of community assets, such as cereal banks and community infrastructures like pumps and wells, leading to some anarchy in resource use. The lack of leadership was also a significant problem. Since the revolution, the traditional power of the Touareg had been weakened, and with the emergence of new powers at the local level, leadership conflicts arose between different groups, particularly the Mallébé and Bellah. These conflicts were exacerbated by the absence of clear rules regarding land access and use, leading to frequent land disputes.

To overcome these challenges, the project revised its approach after a one-year pause. The new strategy favoured an approach more oriented towards social entities than territorial units. The terroir management approach was made more open, promoting learning and adaptation to local realities. The project's role was limited to facilitating debates around consultation, using participatory tools and promoting an interactive communication process with all groups, without favouring any of them. Thanks to this new approach, a consultation framework bringing together all the groups was established. This framework includes representatives of agropastoralists (Touareg, Mallébé, Bellah, Sillubé and Rimaibé Fulani) and herders (Gaobé Fulani, Djelgobé and Dogabé), as well as women and youth. Each neighborhood, social group, or sensibility is represented by elders. Non-resident herders are represented by their hosts, herders who are part of the consultation framework.

The consultation framework meets periodically to discuss matters of common interest and make decisions by consensus. It organizes and coordinates reflections and actions on development in the area, facilitates contacts with the outside world, manages conflicts related to the exploitation of natural resources and ensures the application of management rules. A local convention signed by the populations and the department prefect provides a formal framework for this mechanism. The establishment of this consultation framework has created an essential climate of understanding for the development of the area, where collective interests take precedence over individual claims. In less than three years, this process has led to better natural resource management, the resolution of numerous conflicts and self-managed planning of development actions.

Several key actors played a role in the success of this co-management experience of natural resources. Herders and agropastoralists, as the primary users of natural resources, were integrated into the consultation framework. They actively participated in the development and application of management rules. Herders, often nomadic or semi-nomadic, contributed their knowledge of grazing cycles and water resources, while agropastoralists, combining livestock and agriculture, provided a balanced perspective on land use for crops and grazing. Local leaders, particularly the Touareg chiefs, facilitated the consultation process, playing an important role in mediating conflicts and promoting unity among the different communities. The PSB project, with the help of its facilitators, provided methodological support and facilitated discussions and decision-making. Women and youth were also included to ensure a balanced representation of different needs and perspectives. Finally, technical and financial partners provided essential logistical and financial support for the implementation of development initiatives.

Many factors contributed to the success of this co-management initiative. First, the approach focused on key resources and effectively mediated the initial conflicts, particularly those related to the management of hydraulic infrastructures. Next, the appreciation of historical, social and cultural

realities was crucial for establishing common understanding and cooperation among the different groups. Active interaction with local populations ensured that decisions and evaluations were widely supported and implemented. The respected leadership of local notables facilitated conflict resolution and social cohesion. Finally, the partnership and synergy between local actors and development partners allowed effective coordination and continuous support, reinforced by decentralized consultation structures called consultation poles.

2.2.12. Hunters as guardians of farmer-herder cooperation in Côte d'Ivoire

This case study focuses on the interethnic relations between Fulani pastoralists and Senufo farmers in northern Côte d'Ivoire. Presented by Diallo (2001), it explores the tensions, conflicts and opportunities for cooperation between these two groups, with a particular emphasis on the role of hunters' associations as security actors in a context of growing distrust towards state structures.

This study examines the migration of the Fulani from Burkina Faso and Mali to northern Côte d'Ivoire, their socio-economic integration, and the complex interactions that arise with the Senufo. Since the 1970s, Côte d'Ivoire has seen a significant increase in the pastoral migration of the Fulani in response to state initiatives aimed at boosting national meat production to meet the growing needs of urban areas. This policy, while beneficial to the national economy, has exacerbated local tensions between the Fulani, as nomadic or semi-nomadic herders, and the Senufo, as sedentary farmers. Conflicts between these groups are primarily due to crop damage caused by Fulani cattle and competition for access to natural resources such as agricultural land and water. The Fulani, also known as Peuls, are cattle herders whose migrations to northern Côte d'Ivoire have been encouraged by state livestock policies. The Senufo are the original inhabitants of the region and primarily engage in subsistence farming as well as commercial cotton cultivation. Their perception of the Fulani as intruders who damage crops and degrade agricultural lands fuels inter-ethnic conflicts.

The Senufo have set up local arrangements to protect their fields and manage relations with the Fulani herders. Traditional hunters play the role of mediators and protectors of fields against damage caused by Fulani cattle. Mobilized by village authorities, they act as a local security force, using both physical means and traditional knowledge to maintain order. Their intervention is often seen as a response to the inefficiency of state structures in providing security. The Ivorian state, by promoting pastoral livestock policies, has often been perceived as favouring the Fulani over the Senufo. This perception has exacerbated local tensions and led to accusations of favouritism and bias. However, the state has also attempted to establish institutional frameworks to manage conflicts and promote cooperation between the two groups.

The factors for successful cooperation between the Fulani and the Senufo include the establishment of institutional and legal frameworks, such as SODEPRA (Animal Production Development Company), which provide infrastructure and veterinary services to the Fulani. Local amicable arrangements allowing the Fulani to obtain land usage rights, as well as the key role of hunters in mediating conflicts, are also essential. Promoting cooperation through service exchanges and compensation-based conflict resolution mechanisms has contributed to fostering a more harmonious coexistence.

2.3. Analysis of success and sustainability factors for farmer-herder cooperation models

Under this heading, we present a comparative analysis of successful models of cooperation between farmers and livestock herders. Through the study of various cases, it highlights the strategies and key factors that have contributed to the success of each model. It identifies best practices that have fostered harmonious coexistence between agricultural and pastoral activities in

different regional contexts in Africa. Each case study is presented in a structured way in order to better understand the dynamics at play. For each case presented, a synopsis is provided to summarize the objectives and actions undertaken, as well as the results achieved.

The study area refers to the geographical location where the initiative was implemented. The information collected also includes the period during which the study was carried out. This information made it possible to locate the cases studied in space and time. Driving factors refer to the elements that motivated or triggered the initiative, be they social, economic, environmental or political pressure. The success factors then highlight the conditions that favoured the success of the project, such as community engagement, good governance or access to necessary resources. Sustainability assesses the ability to sustain the momentum in the long term, even after the external intervention has ended. Finally, each case study is accompanied by a bibliography indicating the source of the information used to document it. The results provide valuable pointers for the development of similar policies and initiatives in other regions facing the challenges of agropastoral integration (Table 4).

Table 4: Comparison of case studies

Study case	Synopsis	Study area	Period	Driving power	Success factors	Durability	Reference
Nexus 'Gah Késsé' agropastoral management model	Agropastoral management model to support agropastoral systems locally and integrate pastoralists socially	Tchatchou, Benin	2022-2023	Technical and financial partners	Strengthening of production factors Creating economic opportunities Socio cultural integration of livestock farmers.	Moderate; requires ongoing support to ensure sustainability and adoption of new practices	Valkonen et al. (2023)
Farming and Fulani coexisting in Agogo: The role of civil society organizations	Conflicts between farmers and herders managed by community-based organizations in Agogo, Ghana	Agogo, Ghana	2009-2013	Local dynamics	Cultural understanding and local perception of organizations.	Low, due to the 'winner takes all' attitude	Setrana (2022)
Agropastoral policy as a management model in Nigeria	Livestock transformation plan to reduce pastoralist-farmer conflicts in Nigeria	Nigeria	2019-present	Public authority	Strong political leadership Public communication Financing Technical capacity building	Moderate to high; depends on successful implementation	Africa Report (2021)
Cooperation and coexistence between farmers and Hherders in Ghana based on social, cultural and historical links	Cooperation and coexistence between farmers and herders in the midst of violent conflict in several regions of Ghana	Kowereso and Zantile, Ghana	June 2013 February 2014	Local dynamics	Daily relationships Social solidarity Community support, traditional dispute resolution mechanisms	High, due to strong social and cultural ties between communities	Bukari et al. (2018)

The case of rice farmers and cattle herders in the Inner Niger Delta in Mali	Sharing of space between agriculture and livestock in the Inner Niger Delta, with legislative and land use changes	Delta intérieur du Niger, Mali	1990-2013	External dynamics	New agricultural practices Decentralized management Integration of customary laws	Low to moderate, due to the complexity of land interactions and legislative changes	Bouaré Trianneau (2013)
Coexistence mechanism between farmers and herders implemented by ANOPER, Benin	Exploration of the dynamics in local use of natural resources and in inter-ethnic relations resulting from development interventions. Fulani are organizing themselves from local to national level to provide technological and socio-cultural services, manage conflicts and gain a stronger political voice.	Gogounou, northern Benin	2008-2012	Local dynamics	Use of new technologies Inter-ethnic collaboration Livelihood diversification Technological innovation Organizational strength Political advocacy	Moderate to high. ANOPER is an organization that mainly represents livestock farmers, and on this basis, it defends these farmers. However, political constraints mean that the players sometimes see it as an unreliable instrument.	Djohy (2017)
Peaceful coexistence: Transforming conflict into cooperation between the Kikuyu and Maasai in Kenya's Lake Naivasha Basin	This case study examines the transformation of conflict into peaceful coexistence between the Kikuyu and Maasai communities in Kenya's Lake Naivasha Basin through inter-ethnic marriages, land rentals	Maasai and Kikuyu of Maiella and Enoosupukia, Lake Naivasha Basin, Kenya	1990s to the early 21 st century	Local dynamics	Establishment of local peace committees composed of community leaders Active involvement of women, particularly those in inter-ethnic marriages, as cultural bridges. Economic interdependence fostered by land rentals.	The sustainability of peaceful coexistence is ensured through: Permanent dialogue structures such as local peace committees; Recognition of mutual economic benefits; Encouragement of interethnic marriages to	Kioko and Bollig (2015)

	and local peace mechanisms.				Introduction of agricultural techniques and commercial activities by Kikuyu women. Community development initiatives and collaborative practices.	strengthen social and economic ties; Effective non-violent conflict resolution mechanisms; and Continued community development and collaboration.	
Collaborative governance enhances livestock water productivity in Ethiopia: A study of indigenous and external structures	Local governance of water resources and pastures to improve water productivity for livestock	Amhara Regional State, Ethiopia	April 2009 - March 2010	Local dynamics	Participatory governance structures Recognition of indigenous governance structures	Moderate, due to existing traditional governance structures	Deneke et al. (2011)
Collective management of grazing lands in Tigray, Ethiopia	Analysis of local governance of water and pasture resources, with a focus on the effectiveness and sustainability of these efforts to enhance water productivity for livestock	Highlands of Tigray, northern Ethiopia	1998-1999	Local dynamics	Intermediate population levels Higher social capital Lower heterogeneity in oxen ownership Experience in running local organizations.	High; sustainable collective action leads to significant regeneration of grazing lands, reduced violation of land use rules and increased community contributions towards land management	
Co-management of natural resources in Kishi Beiga, Burkina Faso	Participatory natural resource management project to resolve conflicts and promote	Kishi Beiga, Oudalan Province, Burkina Faso	1991	Technical and financial partners	Participatory approach Bottom-up planning Inclusive consultation framework	High; improved natural resource management, self-managed development planning and decentralized consultation structures	Banzhaf et al. (2002)

	sustainable development in Kishi Beiga				Learning and adaptation Active engagement with local populations Respected local leadership Effective partnership Conflict mediation Formal local conventions	ensure sustainability and adaptability
Hunters as guardians of cooperation between farmers and herders in Côte d'Ivoire	Conflictual relations between Senufo farmers and Fulbe herders in Côte d'Ivoire	Côte d'Ivoire	1991-1995	Local dynamics	Role of hunters' associations in protection and mediation	Moderate; depends on trust in state structures and traditional associations

Source: *By the authors*

2.4. Sustainable coexistence, cooperation and cohabitation through collaborative governance and resilient communities

Management of natural resources and the promotion of peaceful coexistence between agricultural and pastoralist communities require the adoption of various strategies to address the complex challenges these groups face. This section examines the importance of shared and transparent governance, resilient mediation systems, multi-level and synergistic partnerships, collaborative solidarity networks, resilient and inclusive communities, collaborative resource management, interconnected socio-economic ecosystems, and integrated cohabitation spaces. The review of case studies and theoretical perspectives highlights the effectiveness of these approaches in promoting sustainability, community resilience and harmonious interactions. This analysis draws on key concepts from various case studies, emphasizing how specific approaches have been implemented to achieve these objectives. The selected case studies highlight diverse governance and collaboration practices.

The drivers of farmer-herder integration were grouped into categories and sub-categories. For each category, keywords or expressions have been extracted from the review literature and formulated to indicate a determinant, including, for example, shared and transparent governance, and resilient mediation systems. As shown in the figure, these keywords or expressions have been grouped into sub-categories. The sub-categories are nothing more than convergent or common themes of sets of other keywords and expressions used in the literature to refer to the factors that have endorsed farmer-herder integration in a particular context. For example, when expressions such as 'living together', 'cultural neighbours', 'daily interaction' or 'social interaction' appear, they refer to the 'everyday life' sub-category, which in turn is linked to the 'integrated co-living spaces' category. The scope of each factor category is presented below:

Shared and transparent governance: Shared and transparent governance is essential for the effective management of natural resources in farming and pastoralist communities. Integrating organizational structures, such as collective management committees and community governance systems, can ensure active participation and transparency. Emerson et al. (2012) emphasize that collaborative governance involves decision-making processes and structures that constructively engage stakeholders in achieving public goals. For example, in Ethiopia, local resource management structures demonstrate how transparency and participation can not only improve resource management but also reduce conflict (Gebremedhin et al. 2004; Deneke et al. 2011). Water and pasture management committees, as well as pasture rotation systems, are examples of participatory mechanisms that have proven to be effective. These initiatives include regular community meetings for planning activities, mediation processes to resolve conflicts and transparent audits to ensure that all actions are well documented and accessible to all community members. Such practices build trust among stakeholders and promote sustainable and equitable use of natural resources.

Resilient mediation systems: Resilient mediation systems are important for managing conflict and promoting peaceful coexistence. Several case studies show that local governance structures, such as water user associations and community committees, or professional organizations such as ANOPER in Benin, can effectively enforce rules and resolve conflicts through the active participation of community members (Diallo 2001; Deneke et al. 2011; Djohy 2017). These actions facilitate communication between the actors and also make it possible to find adaptation strategies such as circumstantial cohabitation or the forced sedentarization of pastoralists (Valkonen et al. 2023). The effectiveness of these systems depends heavily on the ability of local institutions to anticipate and manage conflicts.

Multi-level and synergistic partnerships: Multi-level and synergistic partnerships involve collaboration between various institutions and organizations for effective management of natural resources. These synergies help ensure that the concerns of vulnerable groups are taken into account in decision-making processes, thereby enhancing policy equity and inclusiveness. However, power differentials and divergent goals can hinder these partnerships. The National Livestock Transformation Plan (NLTP) in Nigeria, for example, shows how the federal government, state governments and local institutions can work together to modernize the livestock sector and reduce farmer-herder conflict (NEC 2019; International Crisis Group 2021). Similarly, the Nexus 'Gah Kêssê' agropastoral management model in Tchaourou, Benin, exemplifies this concept by integrating shared governance practices that actively engage farmers and herders in the sustainable management of natural resources (Valkonen et al. 2023). This model is supported by institutions such as the High Commission for the Sedentarization of Herders (HCSE) and the Association for the Development of Borgou Municipalities (ADECOP) etc. In Burkina Faso, the Kishi Beiga Natural Resource Co-management Project shows how local public institutions, in collaboration with non-governmental organizations (NGOs) and local communities, can put in place participatory governance structures to ensure equitable and sustainable use of resources (Banzhaf et al. 2002). These examples show that, despite the challenges, multi-level partnerships play an important role in promoting sustainability, community resilience and peaceful coexistence.

Collaborative solidarity networks: Collaborative solidarity networks, including social dynamics such as social cohesion and inter-community relations, are vital to building community resilience. According to Borrini et al. (2000), collaborative resource management involves joint decision-making between the government, communities and NGOs. This networking promotes conservation and livelihood goals in an equitable and sustainable manner (Banzhaf et al. 2002; Deneke et al. 2011). Solidarity networks within and between Fulani communities and farmers show how economic and social cooperation can strengthen community ties and prevent conflicts. These organizations facilitate visits between actors and the development of inter-ethnic relations that can lead to mixed marriages or technical assistance in the development of certain activities (Bukari et al. 2018). Long-term ethnography by Djohy (2017, p.220) among farmer and pastoralist communities in northern Benin has identified intermarriage as key to social integration essential for sustainable agropastoral livelihoods.

Resilient and inclusive communities: Resilient and inclusive communities, including diverse ethnic and specific groups, are essential for sustainable community resilience. The work of Carmen et al. (2022) show that inclusiveness in adaptation initiatives facilitates the mobilization of social capital for their success. By incorporating the perspectives and needs of all community groups, these initiatives become more robust and effective. Failure to take local natural resource rights and practices into account can lead to conflict and resistance. Therefore, it is vital to design adaptation programs that respect and integrate local customs and traditional governance systems. In addition, advocacy and participation efforts need to be intensified to ensure that all voices are heard and that there is broad support for proposed solutions. The case studies reveal the implications of women's organizations, youth, diaspora and traditional leaders etc. (Diallo 2001; Setrana 2022). Such practices build trust among stakeholders and promote sustainable and equitable use of natural resources.

Collaborative resource management: Collaborative resource management, especially in shared areas such as pastures and agropastoral zones, is essential for the sustainable use of natural resources but also for peaceful coexistence between farmers and herders. Smith et al. (2023) indicate that collaboration in the use of natural resources reduces conflict and promotes equitable and sustainable environmental decisions. The use of these resources indicates, for example, the sharing of water resources by rice farmers and herders (Bouaré Trianneau 2013) and the co-management of pastures (Banzhaf et al. 2002).

Interconnected socio-economic ecosystems: Interconnected socio-economic ecosystems integrate economic activities and community events to strengthen social and economic connections. Bouaré-Trianneau (2013) and Valkonen et al. (2023) indicate that participatory and integrated approaches can improve the economic and social resilience of communities. These approaches can be commercial, as livestock markets, bundling mechanisms and the marketing of products such as cereals, milk and meat bring different communities closer together and promote complementarity between farmers and herders. Other exchanges may also revolve around fertilization/manure contracts and the implementation of rotational grazing systems to improve soil fertility and livestock feed.

Integrated cohabitation spaces: Integrated cohabitation spaces promote daily social interactions and cultural proximity essential for social cohesion. Uskul and Over (2014) pointed out that daily interactions can improve resilience and social cohesion between farmers and herders. The relationship between farmers and Fulani herders is a good illustration of this. The Fulani, despite occasional conflicts, maintain cultural neighbourly relations with farming communities, sharing resources and participating in community activities such as religious ceremonies and product exchanges. For example, in the Zantile community case study in Ghana, the Fulani integrate by respecting local laws, participating in prayers in local mosques and exchanging gifts during religious holidays such as Eid. These routine practices of daily peace, based on mutual respect and social solidarity, are essential for maintaining harmonious relationships even in times of tension. In this context, cultivation practices that intermingle neighbours not only resolve conflicts but also forge lasting cooperative relationships through mutual understanding and shared norms. Thus, spaces of integrated coexistence, when well managed to include the active participation of local communities, can become models of community resilience and social cohesion, fostering positive cultural interactions on a daily basis (Figure 3).

Figure 3: Concept analysis of collaborative governance and resilient communities in farmer-herder integration models (by the authors).



2.5. Mechanisms of cooperation, co-existence, cohabitation and collaboration between farmers and herders

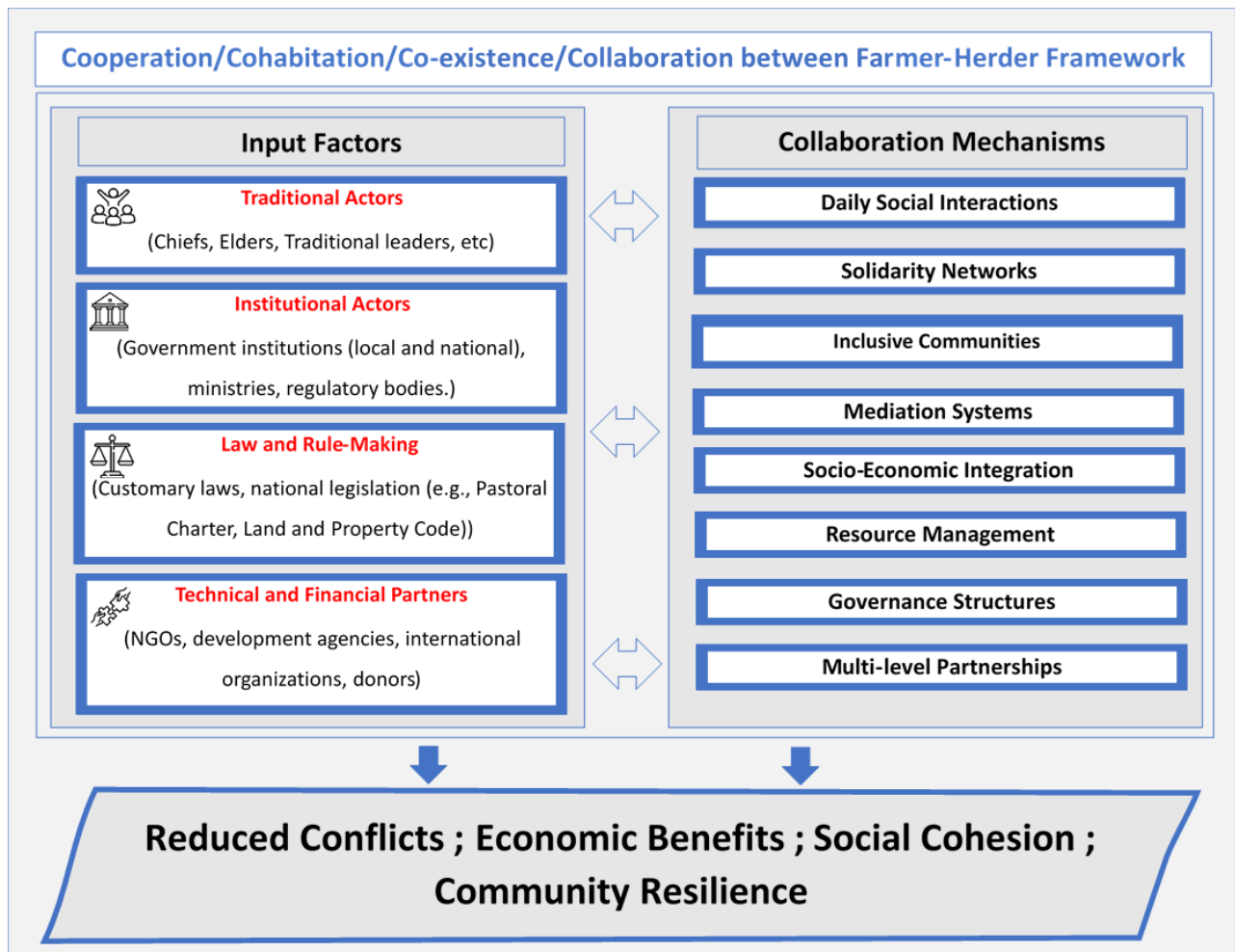
This section presents a proposed conceptual framework for cooperation between farmers and herders. It highlights the complex interactions and mechanisms required to promote sustainable coexistence, based on lessons learned from the various case studies. Input factors include traditional actors (chiefs, elders and traditional leaders), government institutions at different levels, customary and national laws and regulations (such as the Pastoral Charter and the Land Tenure and Property Code), as well as technical and financial partners (NGOs, development agencies, international organizations and donors). Collaborative mechanisms include shared governance structures, mediation systems, multi-level partnerships, solidarity networks, inclusive communities,

resource management, socio-economic integration and day-to-day social interactions. Expected positive outcomes include sustainable use of resources, reduced conflict, economic benefits, strengthened social cohesion and increased community resilience.

By integrating various actors and input factors, such as traditional actors, government institutions, customary and national laws and regulations, as well as technical and financial partners, this framework underlines the importance of a holistic approach. The collaboration mechanisms identified—including everyday social interactions, solidarity networks, inclusive communities, mediation systems, socio economic integration, collaborative resource management, shared governance structures and multi-level partnerships—play a crucial role in facilitating cooperation between farming and pastoral communities. Day-to-day social interactions and solidarity networks, such as cultural and economic exchanges, strengthen community ties and prevent conflict. The analysis also shows that the implementation of these collaborative mechanisms leads to significant positive outcomes, such as sustainable use of resources, reduced conflict, increased economic benefits, strengthened social cohesion and improved community resilience. Peaceful coexistence and effective management of natural resources are made possible through inclusive governance and the active participation of women, young people and marginalized groups.

This framework (Figure 4) highlights the importance of partnerships between different actors and inclusive governance mechanisms to establish lasting and harmonious results within the agropastoral communities. In short, this conceptual framework shows that farmer collaboration is based on a combination of input factors and well-organized collaboration mechanisms, leading to beneficial outcomes for both individuals and communities. Through this comprehensive approach, it is possible to manage natural resources sustainably while promoting harmonious and economically productive coexistence between agricultural and pastoral communities.

Figure 4: Positive farmer herder integration framework (by the authors).



Several models of farmer-pastoralist integration have proved effective, such as community-based resource management and mediation mechanisms led by traditional leaders or NGOs. These successful models rely on key factors such as well-defined laws, active involvement of government institutions and enriching social interactions that strengthen community ties. For peaceful and sustainable coexistence, it is essential to develop inclusive models that promote shared governance, involve all relevant actors, including marginalized groups, and foster multi-level partnerships. These approaches not only facilitate equitable management of agropastoral resources but also contribute to greater resilience and social cohesion in communities.

Figure 4 summarizes the socio-institutional actors and entities as well as the collaboration mechanisms to be promoted to help strengthen farmer-herder integration. It is clear, for example, that customary authorities play a key role in smoothing out day-to-day social relations, maintaining cultural proximity/neighbourliness and preserving solidarity networks. Government institutions, bureaucracies, decision-making and legalization/juridification processes must learn to be more inclusive, respectful of their own established rules and promoters of fair mediation mechanisms. Development agencies and technical and financial partners must play a catalytic role in building inclusive, sustainable multi-stakeholder partnerships that promote non-negotiable values of good governance and accountability.

3. Conclusion and recommendations

The coexistence of pastoralists and farmers in agropastoral systems in Africa is essential for sustainable development and conflict resolution. The case studies analysed show that practices involving shared governance, resilient mediation systems, multi-level partnerships, collaborative solidarity networks, inclusive and resilient communities, collaborative resource management and interconnected socio-economic ecosystems are crucial to promoting harmonious coexistence. This research made it possible to make recommendations to various stakeholders.

Herders and farmers:

Strengthen local governance structures for transparent and equitable management of natural resources.

Promote collaboration and solidarity within farming and pastoralist communities.

Actively participate in solidarity networks and community events to strengthen social and economic ties.

Public authorities:

Implement inclusive policies that take into account the needs and perspectives of all communities.

Ensure the active participation of women, youth and marginalized groups in decision-making processes.

Provide financial and technical support for local resource management and conflict resolution initiatives.

Facilitate the creation of multi-level partnerships for effective policy implementation.

Research actors:

Continue to research on the mechanisms of cohabitation between herders and farmers, with a focus on successful local practices.

Disseminate research findings to inform policy and practice.

Develop and promote innovative technologies to improve the productivity and sustainability of agropastoral systems.

Work with communities to adapt these technologies to their specific needs.

The adoption of these recommendations will contribute to the involvement of all stakeholders. This involvement is a vector of peace, social cohesion between agricultural and pastoral communities, and sustainable and equitable management of natural resources.

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