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Agriculture Extension Service for Smallholder Livestock Farmers in Communal Land of Mopani District in Limpopo Province

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ABSTRACT

Limited access to agriculture-led livestock extension officers remains a major constraint for smallholder livestock farmers in Mopani District, South Africa. Consequently, agricultural extension services often fail to priorities direct and context-specific approaches that could meaningfully improve the livelihoods of livestock farmers operating on communal land. This article critically examines and repositions the effectiveness of agricultural extension services for smallholder livestock farmers within communal farming systems. A comprehensive literature review methodology was adopted, drawing on 28 peer-reviewed journal articles, 15 government reports, and six university thesis repositories. Published literature from 2009 to 2025 was retrieved using multiple scientific search engines. The review reveals that the effectiveness of livestock extension in communal systems depends less on government delivery capacity and more on policymakers' understanding of communal livestock production systems and their commitment to addressing farmers' needs. The findings highlight the importance of integrating indigenous knowledge, climate-smart livestock practices, and participatory knowledge-sharing mechanisms to strengthen linkages between research, policy, and practice. The study recommends repositioning extension services through enhanced stakeholder engagement, continuous professional development of extension agents, stronger collaboration with non-governmental organizations and private sector actors, and the strategic use of digital tools to improve information dissemination. In conclusion, the sustainable transformation of communal livestock agriculture in South Africa depends on extension services that empower smallholder farmers as co-creators of knowledge and responsible custodians of communal resources.

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Introduction and Background

Agricultural extension services play a crucial role in articulating a functional and institutional framework for livestock development under communal systems, mainly owing to the trend of diversification of economic activities. Limited access to specialised agricultural support officers for livestock care is a significant challenge for smallholder livestock farmers in South Africa. Agricultural extension officers are government officials who collaborate directly with farmers to provide agricultural extension services (Sebopetsa, 2018; Agwu *et al.,* 2023). This includes essential information and abilities towards enhancing agricultural production. Subject matter specialists, private organisations and government entities, through regular consultation and guidance, provide information and knowledge (Nkosi, 2017).

Livestock farming plays a crucial role in the rural economy of South Africa. It serves as a vital source of income, ensures food security, and contributes to the cultural identity and social status of rural households (Erdaw, 2023). In many rural areas, especially within Limpopo Province, smallholder farmers rely on livestock like cattle, goats, and sheep for purposes such as investment, insurance, and diversifying their livelihoods (Nkadimeng, 2019). In a communal system, land is held in trust and usually managed by traditional leaders. Households have usage rights instead of formal title deeds. This arrangement is crucial for smallholder farmers because it gives them secure access to land for their livestock farming activities (Mokwena *et al*., 2020). This arrangement provides smallholder livestock farmers with access to grazing resources (Erdwa, 2023), yet it also brings forth distinct challenges such as land degradation, uncontrolled grazing, and insufficient investment in infrastructure stemming from unsecured tenure (Ntumva, 2022). Stakeholders must address these challenges by implementing measures such as sustainable land management practices, community-led grazing plans, and increased investment in infrastructure (Hall and Kepe, 2017). There is a noticeable consensus on the value of agricultural extension support services as an essential element in ensuring effective and efficient implementation of government interventions and competent facilitation of developing programs in rural areas (Lukhalo, 2017). According to Becerra-Encinale *et al*. (2024) and Suvedi *et al*. (2017), consistent engagement and tailored information are essential components of effective extension services, which play a crucial role in promoting positive attitudes and enhancing the adoption of various agricultural technologies among smallholder farmers. However, Brown *et al.* (2018) argue that the effectiveness of extension services is exaggerated, as these services frequently do not adequately address the varied socio-economic challenges encountered by smallholder farmers. Furthermore, relying solely on customised information may ignore the significance of local knowledge and traditional practices, both essential for sustainable agricultural development (Adefila *et al*., 2024). To ensure that information is pertinent and accessible to a diverse group of farmers, such services should ideally combine both individual and group approaches to facilitate knowledge transfer and skill development (Prajapati *et al*., 2025). Nevertheless, farmers must have access to extensions and advisory services to optimise their production (Nkosi, 2017). Hence, agricultural extension as a rural support pillar must overcome new challenges that threaten agriculture (Somanje *et al.,* 2021).

Experts have proven that advanced training programmes, such as workshops, on-field training sessions, and digital platforms, significantly enhance farmers' knowledge and skills. This improvement leads to noticeable increases in productivity (Raji *et al*., 2024). Capacity-building programs are essential for extension officers to effectively help adopt advanced agricultural innovations and offer specific guidance on livestock management and market access (Abdullah *et al*., 2021). Capacity-building initiatives are crucial for extension officers to effectively promote the adoption of complex agricultural innovations. These initiatives promote approaches that respect traditional practices while integrating modern, sustainable livestock management techniques (Adelifa *et al*.,2024). For example, farmer-to-farmer extension methods involve experienced farmers training new farmers to improve traditional extension services using local knowledge and promoting peer-to-peer learning (Kiptot and Franzel, 2015).

According to Kumar *et al*. (2020), participatory methods and adult learning principles are needed for effective knowledge co-creation and distribution, as well as technical agricultural knowledge. The long-term adoption of agricultural innovations and the development of strong local innovation capacities rely on the trust and intentionality promoted by these participatory approaches (Ochieng *et al*., 2022). South Africa cannot afford to implement programmes and policies aimed at smallholder farmers who do not work, seemingly not because they are not working, but because the clear-cut challenges faced by farmers were not identified correctly (Khapayi and Celliers, 2016). Improving livestock farmers' production under communal farming should be realised through understanding their farming goals, perception, and rearing experience (Musemwa *et al*., 2008).

Mopani District, in the northeastern region of Limpopo, boasts a distinctive agricultural landscape where the constructive collaboration of commercial farming and widespread smallholder agriculture within communal tenure frameworks creates a vibrant tapestry of rural life (Hay, 2015). This region is characterized by semi-arid conditions with recurring drought and land degradation, supporting thousands of household's dependents on livestock. In communal tenure systems, land is collectively shared and often overseen by traditional authority. While this system promotes social cohesion and collective resource utilization, it also presents challenges in sustainable land management, investment incentives, and resource allocation (Hall *et al*., 2018). Mopani District extension service is organized to render comprehensive support to farmers. Animal health technicians focus on animal health, while natural resource technicians oversee environmental concerns. Service delivery is structured through a network of offices at the district level, municipal agroecological zone agricultural offices, and service centres located within each agroecological zone. Smallholders, especially those involved in livestock farming on communal land, encounter challenges such as tenure insecurity, resource deprivation, and lack of institutional support (Azadi, 2022). Extension service centres in Mopani, like those in Vhembe, encounter major challenges, such as inadequate infrastructure, insufficient water supply, and limited information dissemination capabilities (Zikhali, 2020). Historically, smallholders in Mopani have experienced constraints in training opportunities and have been deficient in essential inputs and skills (Maponya, 2016). According to Akpalu (2013), most farmers have little or no access to extension services. When available, these services typically consist of verbal instructions rather than providing practical support.

The current extension service for communal livestock farming lacks tailored support for the unique needs of smallholder farmers, hindering its intended impact. Improving agriculture-led livestock extension is crucial for enhancing the livelihoods of rural livestock farmers in communal areas, considering their significant role in local communities. While agricultural extension is recognized as crucial, a significant gap exists between the services offered and the specific needs of smallholder livestock farmers in Mopani's communal tenure. Current extension methods often lack tailored strategies that account for the unique socio-cultural, environmental, and economic conditions of community rangeland management. Therefore, implementing a 'broad blanket' system for all livestock farmers may overlook critical challenges unique to their communal farming practices, hindering effective solutions. Not implementing a more thoughtful approach will hinder extension services from significantly enhancing livestock productivity and combating rural poverty in the district. Hence, the objectives of the article are as follows:

(i) To identify the relevant theoretical foundation to support extension systems in the Mopani district.
(ii) To review the role of agricultural extension in communal livestock rearing.
(iii) To present the knowledge transfer and capacity thinking among extension officers and farmers.
(iv) To discuss the integration of the indigenous knowledge system in the communal system.
(v) To discuss the climate-smart livestock system in communal settings.
(vi) To present challenges encountered in the agricultural extension system in delivering agricultural services.

Research methodology

The study adopted the systematic review methodology encompassing peer-reviewed articles, scientific articles, government policies and reports, and university repositories, providing the required studies to undertake this research. This approach enhances understanding of the complexities involved in agricultural extension for smallholder livestock farmers, especially in communal land contexts, by integrating various perspectives and empirical findings from multiple studies. This indicates that numerous articles were consulted, and the viewpoints were gathered to serve as the foundation and criteria for this paper. The database search employed various scientific search engines, including Scopus, ScienceDirect, and Google Scholar, focusing on articles published from 2009 to 2025, using specific keywords related to livestock farming within a communal system. The documents mentioned above were evaluated as they were relevant to providing advisory services to smallholder livestock farmers through an agricultural extension system within a communal system. The study reviewed and updated the key findings from existing literature by integrating the verdicts and perspectives from different empirical studies. Hence, the information was collected as per the objective of this paper.

Factors promoting the effectiveness of extension the communal system

Theoretical foundation for positioning agriculture extension

The study adopted several theoretical frameworks selected to match the goals and conditions of smallholder livestock farming in the Mopani District's communal land tenure systems. These theories are essential in shaping the design, implementation, and expected results of agricultural extension services in rural areas with limited resources. The integration of these theoretical perspectives is essential in communal areas, where farming systems are shaped by ecological factors as well as complex socio-cultural, institutional, and governance dynamics (Cousins, 2009). Collectively, these theoretical frameworks establish a robust basis for examining the effective repositioning of extension services to assist smallholder livestock farmers in Mopani District. They conceptualise extension not solely as a top-down technical intervention but as a dynamic, participatory, and adaptive process that must be tailored to the lived experiences of communal landholders. Adopting a multi-theoretical framework was not only methodologically appropriate but also crucial for formulating context-sensitive recommendations.

Agricultural Innovation Systems (AIS)

This framework conceptualises agriculture extension as a multifaceted network of stakeholders, institutions and policies that collectively produce, diffuse, and use agricultural knowledge and innovations. From its perspective, farmers are not just recipients of information but participants in finding solutions for their farming challenges in communal areas such as Mopani. This AIS approach is particularly relevant due to the involvement of diverse stakeholders like traditional leaders, extension officers, researchers, non-governmental organisations (NGOs), and informal markets (Klerkx *et al*., 2012). A well-positioned extension service functions as a facilitator within this innovation system, ensuring that knowledge flows effectively across institutional and cultural boundaries. For smallholder livestock farming in Mopani, this means integrating local knowledge, modern approaches and adaptive technologies that solve communal land realities.

Diffusion of innovations theory (Everett Rogers, 2003)

This theory offers a fundamental comprehension of the adoption of new agricultural practices, including enhanced animal husbandry, bush encroachment control, and digital advisory tools, within farming communities. The aim is achieved by identifying innovators and early adopters to pilot new practices. The adoption within communal land systems is influenced by a variety of factors, including social norms, such as

community traditions and values; traditional authority structures, like tribal leadership; and communal decision-making processes, such as consensus-building meetings. Implementing this theory in Mopani District would empower extension services to tailor strategies for introducing livestock innovations that resonate with community values, leading to more successful and sustainable agricultural practices. These innovations would eventually reach all smallholder livestock farmers within communal land. Extension officers should customise their strategies to align with community values by leveraging the influence of opinion leaders and early adopters. In Mopani, the precedence of communal consensus over individual adoption necessitates an understanding of these socio-cultural dynamics for effective extension interventions. This approach has been shown to result in more effective, inclusive, and sustainable agricultural development, as evidenced by increased productivity, improved livelihoods, and long-term environmental conservation (Hoeberling, 2016).

Participatory rural development (PRD) theory

PRD theory criticises top-down development models and emphasises the crucial involvement of rural smallholder livestock farmers in planning, implementing, and evaluating development interventions. Processes that start locally and move upwards empower communities, support sustainability, and lead to development outcomes that are more relevant and resilient compared to solutions imposed from outside. Communities bring about lasting change by voicing their needs and suggesting solutions themselves. Regarding livestock extension, PRD encourages approaches like farmer field schools, community-based animal health systems, and inclusive planning sessions. Extension models in the communal areas of Mopani District should align with local knowledge systems and traditional livestock practices. PRD encourages mutual learning, fostering a collaborative relationship between extension workers and farmers for sharing knowledge (Gaur *et al*., 2024). Applying PRD theory to position extension services includes involving smallholder farmers as key participants in rural innovation and development, ensuring that solutions are context-specific, sustainable, and equitable.

The role of agricultural extension in communal contexts

The principal institutional framework for the transfer of technical information, innovation, and advisory support to rural farmers is agricultural extension services (Kaur and Kaur, 2018). In communal land systems like those in Mopani District, according to Becerra-Encinales *et al*. (2024), Khwidzhili and Worth (2019), as well as Raidimi and Kabiti (2019), the function of extension goes beyond mere technical support, encompassing facilitation, empowerment, and socio-economic integration. In communal contexts, smallholder livestock farmers encounter distinct challenges, including underdeveloped infrastructure, restricted access to formal markets, and social and economic marginalisation. The communal arrangements influence both land farming practices and the dissemination of innovation, resulting in a uniquely intricate and socially integrated role for extension in these contexts.

Knowledge Transfer and Capacity Building

The dissemination of relevant agricultural information, the promotion of best practices, and the provision of opportunities for farmers to use these practices in their own local contexts are all components of the knowledge transfer process, which is a complicated process. Capacitating the farming community is a key developmental element in assisting farmers in operating an entity through improving management skills (Nyawo and Mubangizi, 2021). In communal settings, farmers frequently face obstacles like restricted access to resources and information. Agricultural extension can bolster their adaptive capacities, leading to enhanced sustainability (Bahta, 2021). Farmers who consistently engage with extension officials often achieve improved results during agricultural emergencies, like droughts, highlighting the importance of prompt and efficient information sharing. The capacity of farmers to adjust to shifting conditions, including climate variability, frequently relies on their access to extension services that facilitate adaptive agricultural practices. Technical project visits and informal

training were identified as effective approaches for enhancing farmers' skills and knowledge within communal land (Manyakanyaka *et al*., 2022). Hence, more access to extension and advisory services is required to attain farming goals.

Integrating Indigenous Knowledge Systems

Agricultural extension services are crucial in enabling the exchange of information and methods among smallholder producers, particularly in community settings. In numerous areas, especially those marked by traditional agriculture practices, incorporating local knowledge systems into agricultural extension can result in more sustainable farming and ultimately enhance food security (Thomas *et al*., 2022). Integrating indigenous knowledge into agricultural extension services acknowledges cultural heritage while utilising effective practices that have been historically suited to suit local environmental conditions (Hlatshwayo and Worth, 2019). Enhancing the ability of farmers to integrate indigenous knowledge efficiently necessitates targeted training and educational programs provided through extension services. This initiative must focus on imparting modern agricultural practices while also highlighting the significance of local techniques, fostering a blended knowledge system that capitalises on the advantages of both approaches. This approach is likely to enhance trust and collaboration between extension officers and the agricultural community. Despite the possible advantages, merging indigenous knowledge into agricultural extension services encounters multiple obstacles. A significant obstacle is the belief that indigenous knowledge is less valuable than scientific methods, resulting in a disregard for traditional practices by extension workers (Wolford *et al*., 2013). The integration of indigenous practices may not be fully realised without a thorough understanding and appreciation.

Promoting Climate-Smart Livestock Systems

Agricultural extension services are essential for providing smallholder farmers with the necessary expertise and resources to improve resilience against climate change. In community settings, where livestock production is a primary source of livelihood, integrating climate-smart agriculture (CSA) principles into extension services is essential for advancing sustainable practices and enhancing food security (Mujeyi *et al*., 2021). Emphasising the importance of adopting CSA techniques is crucial for smallholder livestock farmers in addressing the challenges posed by climate change (Amosah *et al*., 2023). Agricultural extension services provide essential advice in implementing these practices, promoting a collaborative approach where farmers can learn from both traditional wisdom and modern innovations. Effective extension systems not only introduce modern technologies but also adapt them to fit the specific conditions of the local farming community, ensuring their relevance and effectiveness (Antwi-Agyei and Stringer, 2021). For example, programs that educate extension officers to share information about climate-smart practices, such as integrated crop-livestock systems, can enhance farmers' capacity to embrace these strategies.

Despite the potential benefits, several challenges hinder the effective implementation of climate-smart extension services. Factors such as limited resources, inadequate training, and lack of access to climate-related data can hinder extension officers' ability to effectively assist farmers (Shani, 2024). Moreover, the belief that modern agricultural approaches are more effective than traditional methods can hinder the integration of local expertise, thereby limiting the adoption of CSA practices. It is crucial to address these differences to foster inclusive agricultural development and ensure equitable access to climate-smart solutions.

Challenges Encountered by the Agricultural Extension System in Delivering Agricultural Services

Agricultural extension services play a crucial role in fostering rural development, sharing knowledge, and encouraging sustainable farming practices. In communal land contexts like Mopani District, the effectiveness of extension systems often faces a variety of interconnected challenges. These constraints arise from various social, structural, institutional, and environmental factors, each impacting service delivery experiences differently. The elements listed below are recognised as distinct challenges.

Socioeconomic and cultural

Agricultural extension services aim to improve the productivity and sustainability of farmers with small land holdings, particularly in shared land areas. However, obstacles like limited resources and traditional beliefs often reduce the effectiveness of these services, hindering the delivery of essential agricultural support. To overcome these challenges, agricultural extension services should blend traditional and modern agricultural practices to support local traditions and improve sustainability (Tamang *et al*., 2020). A major issue is the unequal education levels among farmers, which limit their ability to adopt modern farming techniques, causing agricultural development to stall (Raidimi and Kabiti, 2019).

Many farmers lack the necessary training to make informed decisions, leading to a situation where they heavily rely on extension services that may lack the resources to address these gaps effectively. Continuous training and skill development for farmers and extension agents is vital to improve agricultural productivity and resilience. Ignoring continuous capacity building when designing extension programmes can result in a lack of progress and a reduced ability to adapt to challenges (Raidimi and Kabiti, 2019). However, agricultural extension services often give more importance to new scientific methods, which may devalue indigenous knowledge. As a result, farmers may be hesitant to join extension services, perceiving them as not aligned with their cultural heritage and customs.

Land Disputes and Conflicts

Land conflicts and disputes are significant challenges for agricultural extension services in areas like Mopani District. These issues are worsened by factors like bush encroachment, livestock theft, historical grievances, resource competition, and external economic pressures. In areas with such conflicts, agricultural extension services often face challenges that affect their effectiveness (Ngongo *et al*., 2023). These conflicts disrupt agricultural activities and erode trust between communities and extension teams. When land boundaries are ignored, extension services may struggle to engage with farmers worried about potential land loss from disputes (Opatpatanakrit *et al*., 2022). Conflicts can lead to land abandonment, exacerbating food insecurity in vulnerable populations. These concerns reduce the effectiveness of agricultural extension services by shaking farmers' confidence and willingness to follow recommended practices. Training programmes on conflict resolution, dialogues, and negotiation strategies can help farmers and extension agents address disputes proactively.

High Agent to Farmer Ratios

One significant challenge faced by agricultural extension systems in communal land settings is the high ratio of farmers to extension agents. This imbalance limits access to necessary information and technical support, which hinders the effective implementation of modern agricultural practices (Tafida *et al*., 2024). The Food and Agriculture Organisation (FAO) recommends an ideal ratio of one extension agent to 300 farmers for effective engagement (Bruinsma, 2017). In many communal areas of South Africa, particularly in Limpopo Province, the ratio often exceeds one extension agent for every 800 or even 1,000 farmers, greatly limiting the quality and frequency of interactions between farmers and extension services (Davis and Terblanché, 2016). These conditions limit personal advisory services, require generic group-based training, and hinder follow-up support, impeding the adoption of innovations in agriculture. Regular and ongoing oversight is crucial in communal livestock systems, involving monitoring grazing patterns, disease control, and fodder management. Long gaps between visits lead to missed chances for interventions, resulting in production losses. The limited time for interaction hinders extension agents from keeping up with modern technologies, diminishing their role as educators and change facilitators.

Policy-practice gaps

In South Africa, agricultural extension policies emphasise farmer-centred, participatory, and demand-driven service provision; yet their implementation in communal land contexts such as Mopani District remains inconsistent. Significant disparities between policy intent and field-level practice undermine service delivery and reduce programme effectiveness (Alvi *et al*., 2021). One major reason for this inconsistency is the mismatch between the goals of national or provincial policies and the specific needs of local farming communities. Policies are usually created with general goals but little involvement of local stakeholders, leading to interventions that do not consider specific local conditions like bush encroachment patterns and seasonal grazing dynamics (Davis *et al*., 2020).

The National Policy on Extension and Advisory Services advocates integrating indigenous knowledge, promoting pluralistic service provision, and strengthening participatory decision-making (DAFF, 2016). However, institutional fragmentation, resource constraints, and top-down programme design limit its practical application. Local extension offices often suffer from understaffing, lack of training, and shortages in logistical support, which force officers to focus on measurable tasks like attending meetings rather than achieving long-term results such as higher adoption rates or improved productivity. Although policy frameworks encourage inclusive planning, decision-making processes remain largely centralised, with minimal input from farmer organisations and traditional leadership. This ongoing disconnect between policy and practice limits the ability of extension systems to provide suitable, efficient, and enduring support to smallholder livestock farmers in communal tenure systems.

Recommendations for positioning extension and advisory service for greater impact

This study emphasizes the need to transform extension policies into action-oriented programs that are sensitive to local realities and can enhance the effectiveness of agricultural extension services in communal land contexts. Inclusive policy formulation processes involve farmers, community leaders, and traditional authorities actively participating to ensure that initiatives reflect context-specific requirements. Ongoing professional development for livestock extension officers is important, with a focus on integrating indigenous knowledge systems alongside contemporary agricultural practices to enhance service delivery. This dual approach can improve trust, relevance, and adoption of extension advice. Recruiting more extension personnel and establishing decentralised, localised extension units is essential to reducing the current high farmer-to-agent ratio. This would enable more frequent contacts and personalised support for smallholder livestock farmers. It is important to collaborate closely with NGOs, farmer organisations, and private sector stakeholders to combine resources, expertise, and outreach capacity. Such multi-actor engagement can tackle institutional limitations and foster more effective service delivery. Embracing mobile-based platforms and other digital tools to provide timely and accessible agricultural information and advisory services is crucial. These technologies can enhance traditional extension approaches and help bridge spatial and logistical constraints. By executing these strategic recommendations, agricultural extension services can more effectively respond to the complexities of communal land management and foster sustainable agricultural development.

Conclusion

This study examined the role of agricultural extension services in communal livestock farming systems in Mopani District, positioning the analysis within broader debates on sustainability, knowledge integration, and institutional governance. The findings show that while extension services play a crucial role in connecting research, policy, and practice, their effectiveness is hindered by inconsistent policies, high farmer-to-agent ratios, limited resources, and obstacles to farmer involvement. These challenges reflect not only technical shortcomings but also institutional and socio-cultural factors, such as governance arrangements and community norms, which shape service delivery in communal contexts. To overcome these challenges, it is essential to align policy goals with local conditions, involve stakeholders meaningfully, and promote extension strategies tailored to the specific context. Enhancing services by combining traditional knowledge with decentralised delivery methods, collaborations with local cooperatives, and digital advancements can establish extension services as catalysts for resilience, food security, and sustainable livelihoods.

An innovative, diverse, and farmer-focused extension system is crucial for changing communal agriculture in South Africa by encouraging community involvement, improving knowledge exchange, and supporting sustainable methods. The future of communal rangelands depends not just on policies or technologies but on empowering smallholder farmers as collaborators in knowledge creation and protectors of communal resources, influencing sustainable land management practices and building community resilience. Future research should include policy analysis, as well as practical, long-term, and comparative studies that prioritise farmer viewpoints and thoroughly explore the structural, ecological, and technological dimensions of extension services.

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Conflict of interest

The authors declare that there are no conflicts of interest that could be perceived as influencing the objectivity or impartiality of the research.

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